THE EFFECTS OF PRIMING AND CONTINGENT ATTENTION ON NOVEL PLAY EPISODES IN A CHILD WITH AUTISM

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This study evaluated the effects of priming and contingent attention procedures on play variability in a child with autism. During baseline, numbers of novel play episodes, different play episodes, and actions occurred at low rates. Priming procedures did not produce desired change. When contingent attention was implemented, significant increases occurred in novel play episodes, different actions, and different play episodes. These results show that attention contingent on variable play episodes can increase the number of novel responses to play materials. The results are discussed within the context of treatment and future research.

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INTRODUCTION

Play encompasses a wide range of behaviors. Play is often defined as a spontaneous and a voluntary activity that is pleasurable and requires the active engagement of the participant (Linder, 1990). Play is seen as a critical factor in a child's development. Beneficial outcomes of play include motor skills (Musselwhite, 1986), problem solving, and verbal and non-verbal communication (Johnson, Christie, & Yawkey, 1999). Some view play as a vehicle for the social development of skills. For example, play may facilitate turn taking, sharing, and cooperating (Mavintyre, 2001; Sayeed & Guerin, 2000; Musselwhite, 1986; Wolfberg, 1999). Toy play in particular, is considered an important part of social play. According to Johnson, et. al., (1999), toys can serve to facilitate interactions between peers who have difficulty maintaining play exchanges. Toys may often assist children in shifting from parallel to interactive play.

Children with developmental disabilities are often in need of additional support to learn how to interact and/or manipulate play toys. Within the behavior analytic research, studies have utilized various techniques to facilitate play skills (Murphy, Callias, & Carr, 1985; Hardiman, Goetz, Reuter, & LeBlanc, 1975; Haring, 1985; Poteuck, 1989), such as prompting, modeling, and providing reinforcement of appropriate play skills. Another method is priming. Priming is a technique that generally involves two components: training (e.g. prompts, models, etc.) and probe sessions. The probe sessions are typically conducted to assess maintenance and generalization of skills previously taught in the training session. A study of particular relevance to the current research was conducted by Hardiman, et. al., (1975). In this study, investigators implemented a priming procedure

to increase engagement with six specified activities. These activities included motor skills such as rolling down a hill, climbing up a ladder, and balancing on a board. Under the priming condition, the child was instructed (e.g., "roll down the hill") every day during each activity. The teacher walked away from the child, only to attend to her when she was engaged in one of the selected activities. It was found that the priming condition increased the subject's participation in most of the activities.

Although such techniques have been effective in teaching new play skills, most research has focused on simple play responses such as flying a toy airplane, holding a doll and moving it in a walking motion, and pushing a toy car. Haring (1985) taught children with developmental delays specific play sequences with toys, such as moving a toy bug in a straight line. If the child emitted a previously trained sequence, the instructor delivered verbal praise, but if the student did not produce the correct pattern, the teacher said "No" and modeled the correct sequence. Because specific responses were reinforced and variations extinguished, the resulting behavioral patterns might be characterized as stereotypic (i.e., repeating the same behavior sequences). Although play skills training may initially require teaching specific responses, this may lead to a limited repertoire of play skills and, thus a lack of variable play responses.

Variability in responding has received ever-increasing attention in the field of behavior analysis (Denney, & Neuringer, 1998; Eckerman, 1969; Joyce, & Chase, 1990; Machado, 1989; Machado, 1992; Miller & Neuringer, 2000; Morris, 1987; Neuringer, Deiss, & Olson, 2000; Pryor, Haag, & O'Reilly, 1969; Ross, & Neuringer, 2002; Schwartz, 1980). In 1969, Pryor and colleagues trained porpoises to emit novel responses to the same set of stimuli. This outcome provided evidence that variability is

itself an operant. Since that time, a number of studies have been conducted to identify variables that may be responsible for generating variable responding. Reinforcement schedules (Eckerman, & Lanson, 1969; Machado, 1992; Ross, et. at., 2002), instructions (Joyce, & Chase, 1990), and extinction procedures (Machado, 1989; Schwartz, 1980) have all been shown to be factors generating variable responding. Miller and Neuringer (2000) conducted a study with adolescents with autism. The participants played a computer game in which varying sequences were directly reinforced. These data show that behavioral variability in individuals with autism, a population characterized by stereotypic behavior (American Psychiatric Association, 1994), can be reinforced.

Neuringer and colleagues (2000) extended this knowledge to identify which source (i.e., direct reinforcement, non-contingent reinforcement, extinction) would generate high response rates and facilitate acquisition of the targets. Three groups of rats were chosen to one of the following groups: (1) reinforcement of variations (VAR), (2) reinforcement of any responses (ANY), or (3) reinforced for only the target response (CON). The results conclude that both ANY and VAR contingencies maintained higher overall responses than did the extinction group. Furthermore, only the VAR group learned the targets.

Although the topic of variability generates great interest, there are comparatively few studies on play variability (Goetz, & Baer, 1973; Hardiman, et. al., 1975; Lalli, Zanolli, & Wohn, 1994). For children with autism, who typically exhibit excessive stereotypic behavior, this is a particularly important area of research. Generating variable play responses may have a number of benefits. One benefit is that play behaviors may serve as a basis for social interactions. As a child engages in increasingly variable play

behaviors, there are more available opportunities for peers to respond to the child's behaviors. This may lead to increased joint play interactions. Variable play behaviors may also increase the probability of the child sampling and contacting potentially reinforcing events. These events can occur within a social context (e.g., social praise) or a feature or effect of a toy (e.g., the sound of a toy car crashing). An additional benefit may be an increase in control by multiple cues. Rather than the child responding to only a few features of a play apparatus, variability may allow additional features to gain stimulus control of a child's responding. Furthermore, an increase in play may decrease repetitive play. Increasing play variability may broaden the child's repertoire of responses eligible for reinforcement. Expanding such variable play skills may compete with repetitive responding.

In addition to the work by Hardiman et. al., (1975), two studies addressing play and variability are relevant to the current research. Lalli, et. al., (1994) implemented a combination extinction and positive reinforcement (social praise) procedure to promote variable play responses in two children with developmental delays, not with autism. A multiple baseline across participants was employed. Models and prompts were utilized to train new play responses, after which probe sessions were employed. These probe sessions consisted of: (a) providing descriptive praise following the first occurrence of a trained or untrained topography, (b) placing that topography on extinction following three emissions, and (c) repeating the first two steps for each new untrained topography. Although the results demonstrated that extinguishing previously reinforced topographies resulted in variable responding, the numbers of untrained topographies were relatively

low. It is also unknown how these responses maintained when the contingencies were removed, nor if any generalization occurred as a result of the training condition.

Goetz & Baer (1973) utilized social reinforcement to promote variability in typically developing children. Using a blockbuilding task, social attention was delivered when a block formation not previously constructed within a session was built. In the first phase, the teacher reinforced the first appearance of any form, but did not deliver attention if that same form was built within that session. The next phase involved providing attention contingent on the blockbuilding of the same forms. The procedure was identical to the first intervention, with the exception that only forms that had previously been built were followed by the teacher's attention. The results demonstrated that the teacher's attention controlled form diversity in that when attention was delivered contingent on new forms, the number of different forms increased. When this contingency was applied to building the same forms, the number of the same forms increased. As with the Lalli et. al., (1994) study, it is unknown if this variability generalized across materials, nor if variability would have maintained once the contingencies were removed.

The purpose of the present study was to identify a procedure that would generate novel play episodes across multiple sets of stimuli with a child with autism. Two sets of materials, each containing 3 thematic play toys, were utilized. The first intervention included priming play responses with one of the thematic toys. Prompts and extinction procedures were utilized in the priming conditions. These procedures are similar to Hardiman, et. al., (1975) and Lalli, et. al., (1994). Following the priming conditions, a second intervention, attention contingent on novel play episodes, was

implemented. The second intervention replicated and extended the procedures and findings of Goetz & Baer (1973).

METHOD

Participant

The participant was a 4-year-old male who met the DSM-IV diagnostic criteria for autism. The child had adequate speech, however, his sentences were often out of context and perseverative. At the time of the study, the child had been receiving in-home behavioral services for 11 months, at an average of 10-12 hours per week. The child's in-home training emphasized language, auditory discrimination, social, play, and imitative skills. Typically, these play and imitative skills were taught in a discrete trial format wherein the teacher and the child practiced specific play sequences at a table. At the time of the study, the child could imitate a 2-step behavioral sequence. In addition, the child was on a special gluten-free and casein-free diet.

The child's parents reported that, while manipulating play materials, he would display repetitive behaviors (e.g., continuously open and close doors, pushing the same buttons on story books, and pushing a car in a circle numerous times), and would often perseverate on specific words or phrases.

Setting and Materials

The experiment was conducted in a study at the child's home. The study contained a computer, a table, a couch, two chairs, two bookcases, and a video camera. For a complete diagram of the room, see Appendix A.

The following materials were utilized in this study: 1) a toy castle, which included a cannonball, a ladder, a launcher, and three figures; 2) a toy pirate ship,

which included a cannonball, a telescope, a table, a chest, a small boat, and three figures; 3) Robin Hood's Forest ™, which included a cannonball, two snakes, a launcher, two arrows, three figures and a ladder; 4) a dollhouse, which included two beds, a cradle, three figures, a stroller, a table, and two chairs; 5) a pyramid, which included two arrows, two discs, three figures, and a snake; and 6) Little Tykes Main Street™ which included two cars, a helicopter, four figures, two envelopes, a table, a traffic light, and a chair. The materials were separated into two sets. Set 1 included a dollhouse, pyramid, and pirate ship. Set 2 included Robin Hood's Forest™, Main Street™, and castle. These materials were only available to the child during sessions.

Dependent Variables

With each material, the experimenter scored the total number of play episodes, number of different play episodes, number of repetitive play episodes, number of different objects manipulated, number of different play actions, number of different locations contacted, number of new locations contacted, and the number of novel play episodes for each session. Additional dependent variables included the number of requests for attention and duration of engagement with each material. The complete observation code with behavioral definitions, scoring sheets, and protocols are in Appendix B.

Play actions were defined as any manipulation of an object or set of objects, and/or verbalizations related to the play materials. Play actions consisted of the subject holding, pushing, hitting an object with his hand, and/or

verbalizations in the form of an utterance, word, or phrase (see Appendix B for examples).

Objects were defined as any material associated with the play apparatus (e.g., a bed, a car, a cannonball, etc.).

Location was defined as an object's ending placement (e.g. bridge, tree, water, etc.).

A *play episode* began when the subject touched an object with his hand and engaged in an action. An episode ended when: (1) a new action began, (2) when three seconds elapse following an action, (3) when the subject's hand/fingers were taken off an object, or (4) when an object reached its original starting point.

A *different play episode* was defined as an action, or series of actions, that had not been previously emitted with those particular play materials within that session. The total number of different play behaviors was the number of variable play behaviors with those materials within that session.

A *repetitive play episode* was defined as any action, or series of actions, with the same toy, or same class of materials, that occurred three or more times consecutively with a play material and within a session. Repetitive actions were grouped in threes, with each third identical response counting as one repetitive behavior. An example of a repetitive play episode is the child taking a character and moving it in a jumping motion on the bed three times. An additional example is the child taking a character and placing him on a tree, putting another character

on a tree, and then placing yet another character on a tree. This behavior, occurring three times with the same class of materials, would be considered one repetitive behavior.

A *novel play episode* was defined as any action, or series of actions, that has never occurred with that play material during any session. This could include a novel combination of single play behaviors previously emitted by the student.

Engagement was defined as any play action and/or play verbalization that occurred within an interval. Unlike all other measures, a 10 s partial interval recording system was utilized (see Appendix B for examples).

Requesting attention was scored when the child looked in the direction of the investigator for 5 s or longer and/or made statements or requests while looking at the investigator.

Interobserver Agreement

A second observer viewed the videotaped sessions and independently scored 27% of baseline and intervention sessions for all measures. Percentage of agreement for engagement was obtained by dividing the number of agreement intervals by the number of agreements plus disagreements and multiplying by 100. For all other measures (i.e., play episodes, actions, etc.), the number obtained by the investigator was divided into the number obtained by the observer to attain an agreement percentage. For example, if the investigator obtained a rate of 6.8 total play episodes per minute and the observer obtained a rate of 7.6 total

play episodes per minute, then 6.8 was divided into 7.6 for an agreement of 89%. See Appendix C, table 1 for agreement percentages across each measure.

Procedure

Baseline. The first stimulus material was placed in the middle of the study with all components (i.e. characters, cannon, etc.) equal distance from the participant.

The investigator told the child that he could play with the material for 5-min, at which time a bell would ring. The child was then told that when the bell rings, another toy would then be presented to him to play with.

When the child was sitting in the room and/or near the materials, the timer was set for 5-min and the video camera was turned on. If the participant left the room for more than 30 s during any of the 5-min intervals, that segment was considered over and another material was presented. The child was allowed a break at any time between intervals. If the participant tried to communicate with the investigator during any 5-min period (e.g., asking questions) the child was told one time that they could talk after the bell rings. The investigator ignored any further attempts of communication.

The order of presentation for the stimulus materials was systematically rotated (see Appendix A) so that each material was presented the same number of times throughout the study and that no material was presented more than once

within each session. Baseline sessions consisted of three 5-min play segments with three of the six play materials, and were conducted 4 days/week.

Interventions

Prime: Single. In the Prime: Single condition, one material (dollhouse) was selected for training. During the first presentation of the dollhouse, the primary investigator sat near the child and waited 10 s for the child to pick up and manipulate any of the materials. If the child did not respond within 10 s, the investigator prompted the child by placing her hand over the child's hand to guide him to pick up and manipulate a material (e.g., moving a character up the stairs). Following this play episode, the investigator would deliver a positive consequence in the form social attention (e.g., verbal praise, high fives, tickles) or by allowing access to engage in a highly preferred stereotypical response (e.g., spinning wheels on a car). During the remainder of the 5-min interval, the investigator would model play episodes, expand on the child's spontaneous play episodes (i.e., model an additional behavioral response) and prompt the child through various novel play episodes. The models provided by the investigator were both verbal and physical models such as moving a character up the stairs and saying "It's time for bed". The investigator modeled three to four play episodes prior to requiring a response from the child. If the child did not imitate any of these models, the investigator prompted the child in a play episode. Prompts could be verbal (e.g. "Put him in the car"), gestural (e.g. pointing to a car) or physical (e.g. hand-over-hand prompting to place the character in the car).

A positive consequence was delivered when the following criteria were met: (1) the child engaged in a novel play episode without a prompt: (2) the child followed any of the investigator's play models, (3) following a prompted play episode, and (4) when the child varied his play responses (i.e., the child engaged in a previous play episode but a different play episode occurring between the two instances). A positive consequence would not be delivered if the child displayed a repetitive response. If repetitive responding occurred, the investigator blocked those responses and prompted a different play episode.

In each priming session, the dollhouse was presented first, followed by two other materials, and then ending with a second presentation of the dollhouse. Each material was presented for 5-min. The second presentation of the dollhouse involved the same procedures as in baseline. These probes were conducted to identify changes in the child's play behaviors following the training procedure.

Prime: Multiple. The Prime: Multiple condition involved all three materials in Set 1. Each session involved the presentation of only one of these training stimuli as well as two of the three additional stimulus materials with which no training had occurred (Set 2).

The procedure was the same as in the Prime: Single condition with the exception that: (1) all three training materials in Set 1 were selected for training in the form of models, prompts, expansions, and consequence delivery, and (2) the training materials were not presented again within that session. Only one of the selected training materials was trained per session. If, within a rotation, a training

material (e.g., dollhouse) was selected to be presented, but another training material (e.g., pirate ship) had already received training for that session, then the dollhouse was still presented but the procedure for that material was the same as in baseline conditions. The presentations of materials without additional training were probe sessions. Probe data were collected to identify changes in the child's play behaviors that occurred following the training (priming) sessions.

The training materials were systematically rotated so the order of presentation across sessions remained systematic. The sequence with which each material was presented within a session varied (see Appendix C for order of presentation).

Contingent Attention. When a target material was presented, the investigator delivered social attention (e.g., verbal praise, high fives, playing with the child, etc.) following the first three occurrences of any non-prompted play episode. If repetitive responses occurred, the investigator waited for a different play episode to occur before delivering attention. Following the first three play episodes, attention was delivered contingent on a novel play episode or on a novel play sequence. No prompts were delivered during this condition.

In the contingent attention condition, the same materials that were utilized in the Prime: Multiple condition (Set 1) remained the target materials while Set 2 remained under baseline conditions. The three target stimuli were systematically presented so that the same material was not presented more than one time per

session and that all training materials were presented an equal number of times across sessions.

A reversal was conducted following the contingent attention procedure with Set 1. This procedure was the same as the contingent attention condition with the exception that the previously targeted materials were associated with baseline conditions while the other three materials (Set 2) were associated with contingent attention conditions.

Experimental Design. The design for this study was combination of reversals and multiple baselines across play materials. Phase A was baseline. Phase B consisted of priming behavioral responses with one material (dollhouse) while the remaining five materials remained in baseline conditions. Phase C consisted of priming behavioral responses with multiple materials, and was implemented simultaneously across three training materials. Phase D included the contingent attention condition and was first implemented across Set 1, followed by a return to baseline, and the introduction of the condition to Set 2.

RESULTS

Interobserver agreement (IOA) measures were collected for 27% of the sessions across all materials and measures. IOA averaged 94% across all measures. Refer to Table 1 for a breakdown of the percentage of agreement within each measure.

Figure 1 displays a composite record for the cumulative number of novel episodes across Sets 1 and 2. The cumulative numbers of novel play episodes are displayed on the ordinate and successive presentations of the materials are displayed on the abscissa. The top graph displays the results with Set 1, while the bottom graph displays the results with Set 2.

During baseline with Set 1, responding remained stable with the number of novel responses averaging 9.6 episodes per presentation. The priming condition resulted in a slight increase across presentations, simultaneously with the Prime: Multiple condition. Following this slight increase, responding stabilized, averaging 7.8 novel episodes per presentation. Returning to baseline maintained stability in responding with an average of 5 novel episodes per presentation. When the attention condition was implemented, the number of novel episodes increased and continued to increase throughout the phase (average of 28.3 novel episodes per presentation). During the next baseline phase, novel responses were stable, averaging 4.6 novel episodes per presentation. Reversing back to the contingent attention, novel responding increased and continued to increase throughout the remainder of the condition (averaging 24.3 novel episode).

During baseline with Set 2, responding was initially variable, then became stable across sessions 11-16. The average number of novel episodes in this condition was 8.4 per presentation. During the attention condition, the composite number of cumulative novel episodes showed a continual increase throughout the phase (average of 22.7 per presentation).

Figure 2 shows the cumulative number of novel play episodes with Set 1 across all conditions. Data are presented in the same manner as Figure 1, except that the results with each material are displayed, rather than a composite of each set. During baseline with the dollhouse, responding was stable, averaging 1.2 novel responses per session. After priming responses with the dollhouse, the cumulative number of novel play episodes remained constant at zero across all three sessions. In the Prime: Multiple condition, responding increased and then stabilized, averaging 5.6 novel responses. Following the second baseline, novel episodes maintained stability at an average of 1 novel episode across sessions. In the attention condition, the cumulative number of novel episodes immediately increased and continued to increase throughout the phase, averaging 10.3 novel responses per session. Returning to the third baseline, responding stabilized at an average of 1 novel episode per session. Following the second attention condition, the cumulative number of novel episodes immediately increased and continued to increase throughout the phase, averaging 12 novel responses per session.

The middle graph displays the results across all conditions with the pyramid. During baseline, novel episodes initially increased, then became stable across the

last four sessions in that condition (averaging 3 novel episodes per session). Following the Prime: Multiple condition, responding remained stable averaging 2.6 novel episodes per session. Returning to baseline, novel responses maintained stability at an average of 0.8 episodes per session. During the attention condition, novel responding immediately increased (average of 10.6 episodes) and continued to increase throughout the condition. During the next baseline condition, novel responding was stable with the exception of session 41, in which novel episodes increased by 2. Reversing to the attention condition, the cumulative number of novel play episodes showed a continual increase throughout the phase (average of 7.3 novel episodes per session).

The bottom graph displays the cumulative number of novel episodes with the pirate ship. Under the first baseline condition, responding initially increased and then stabilized across four sessions (average of 4.3 novel episodes per session). In the Prime: Multiple condition, responding slightly increased and averaged 4.7 novel episodes per session. In the following baseline condition, the cumulative number of novel play episodes remained constant with an average of 3 novel episodes per session. In the attention condition, the cumulative number of novel play episodes increased and continued to increase throughout the phase (averaging 7 novel episodes per session). In the following baseline condition, novel responses stabilized at an average of 0.6 novel episodes per session. Returning to the attention condition, the cumulative number of novel play

episodes showed a continual increase throughout the phase, an average of 5 novel episodes per session

Figure 3 displays the cumulative number of novel play episodes with Set 2. The data are presented in the same manner as Figure 2. The dotted lines indicate implementation of the differing conditions with Set 1. During baseline with the Robin Hood Forest™, responding was initially stable, then increased across sessions 11, 12, and 14. This increase occurred simultaneously with the Prime: Single condition. Following this increase, the cumulative number of novel play episodes stabilized. The average number of novel play episodes in the baseline condition was 2.9 per session. During the attention condition, the number of novel episodes increased (average 7.6 episodes) and continued to increase throughout the phase.

The middle graph displays the cumulative number of novel episodes with the Main Street™. Under the baseline condition, responding initially increased across sessions and then stabilized throughout the remainder of the condition (average of 2.6 novel episodes per session). Following the attention condition, the cumulative number of novel play episodes showed a continual increase throughout the phase (average of 6.1 novel episodes per session).

The bottom graph displays the cumulative number of novel episodes with the castle. Under the baseline condition, responding initially remained stable; then, corresponding to the Prime: Multiple condition, the cumulative number of novel play episodes began to gradually increase. Responding then stabilized

throughout the remainder of the condition with an average of 2.8 novel responses per session. In the attention condition, the cumulative number of novel play episodes showed a continual increase throughout the phase (average of 6 novel episodes per session).

Figure 4 displays the results for the numbers of play episodes for Set 1. The closed circles represent the total number of play episodes the child engaged in throughout each session, while the open circles represent the total number of different play episodes the child emitted. Data are displayed as rate per minute on in a semi-logarithmic chart. The rate measure is displayed on the ordinate, ranging from .01 to 10 (responses per minute) with successive sessions displayed on the abscissa.

During baseline with the dollhouse, the total numbers of play episodes were on a decreasing trend (averaging 9.5 episodes per minute) while the numbers of different episodes were stable, averaging 1.4 per minute. In the Prime: Single condition, all responding dropped to zero. In the Prime: Multiple condition, both total and different play episodes were on decreasing trends with averages of 5.8 and 2.9 episodes per minute, respectively. Play episodes stabilized in the second baseline condition with the total number of play episodes averaging 3.9 per minute and the total number of different play episodes averaging 1.9 per minute. In the attention condition, both the total number and number of different play episodes increased to an average of 8.9 episodes per minute (total) and 5.1 episodes per minute (different). The next

baseline condition showed variable responding across both measures with the total number of play episodes averaging 9 per minute (range, 2.8 - 9.4) and number of different play episodes averaging 2.3 per minute (range, 0.6 – 2.4). In the second attention condition, the number of different play episodes increased and closely resembled responding during the previous contingent attention condition (average of 6.3 total and 5.5 different episodes per minute).

The middle graph shows the results across all conditions with the pyramid. In the baseline condition, the total numbers of play episodes were variable with a range of 6.4 to 18.6 episodes per minute. The numbers of different play episodes were initially variable, and then became stable with an average of 2.5 responses per min. In the Prime: Multiple condition, the total number of play episodes were stable, with an average of 8.7 episodes per min. The number of different play episodes showed an increasing trend throughout the phase (average of 2.8 episodes per min). In the following baseline condition, both the total number (range 3.4 - 9 episodes per min) and number of different play episodes (range 1.2 - 3 episodes per min) decreased and were variable. In the following attention condition, both the total and different number of play episodes increased and remained variable, with ranges from 10.2 to 15.6 (total play episodes per min) and 4 to 6.2 (different play episodes per min). After returning to baseline conditions, the number play episodes were initially variable, then became stable across both measures, at an average of 11.9 per min (total) and 3.4 per min (different) play episodes per session. In

the following attention condition, the total number of play episodes initially decreased then increased throughout the remainder of the phase (average of 7 play episodes per min). The number of different play episodes increased and continued to increase throughout the condition (average of 4 play episodes per min).

The number of play episodes with the pirate ship are displayed on the bottom graph. During baseline, both total number of play episodes and number of different play episodes were variable with total play episodes ranging from 4 to 10.2 responses per min, and the number of different play episodes ranging from 1.6 to 3.2 responses per min. In the Prime: Multiple condition, both measures immediately increased, then maintained a decreasing trend throughout the phase, with averages at 6.3 per min (total) and 2.8 per min (different). After returning to baseline, the total numbers of play episodes were variable, with an average of 4.2 episodes per min (range, 3.4 – 5.4). The number of different episodes initially increased, then decreased throughout the phase (average of 1.9 different play episodes per min). In the attention condition, the number of different episodes increased to an average of 4.5 episodes per min while the number of total play episodes (average of 5.8 per min) remained similar to the previous baseline condition. The third baseline condition resulted in variable responding across both measures with the total number of play episodes ranging from 0 to 20.4 responses per min and number different play episodes ranging from 0 to 3.8 responses per min. Returning to

the attention condition resulted an increase in the number of different play episodes with an average of 3.2 responses per min. The total number of play episodes averaged 4.8 responses per min.

Figure 5 displays the plays episode results for Set 2. The open and closed circles represent the same measures as in Figure 4. The results of the play episodes with the Robin Hood Forest ™ are displayed in the top graph. Both total and different play episodes were variable throughout baseline conditions. The total number of play episodes ranged from 2.2 to 12.6 per min and number of different play episodes ranged from 0.6 to 3.2 per min. In the attention condition, an immediate increase occurred with the number different play episodes, whereas the total number of play episodes remained similar to the previous condition. On session 43, both measures decreased significantly, but then immediately increased and remained at high levels throughout the study. Total number of play episodes averaged 10.5 per min and number of different play episodes averaged 4.4 per min during this condition.

With the Main Street™, responding was variable throughout the baseline condition. The total number of play episodes ranged from 4.6 to 18.2 per min and the number of different play episodes ranged from 0.8 to 4.6 per minute in this condition. During the attention condition, total number of play episodes decreased and stabilized at an average of 6.9 per min. The number of different play episodes increased and stabilized at an average of 3.9 per min

The bottom graph displays the results for the castle. Baseline conditions resulted in variable responding across both measures. The total number of play episodes ranged from 1.4 to 14.2 per min and the number of different play episodes ranged 1.2 to 3.6 per min. The contingent attention condition resulted in a stable pattern of responding with the total number of play episodes averaging 8 per min and the number of different episodes averaging 3.9 per min.

Figure 6 displays the number of different actions for Set 1. Results are displayed as responses per minute in a semi-logarithmic chart. The top graph shows the results for the dollhouse. In the baseline condition, the numbers of different actions were initially stable, but then became variable towards the end of the condition (range 0.6 – 1.2). In the following Prime: Single condition, responding dropped to zero. In the Prime: Multiple condition, the number of different play actions immediately increased, followed by a significant decreasing trend. The average number of different actions for this condition was 1.7 per min. In the second baseline condition, responding was variable with the number of different actions averaging 1.7 per min. In the attention condition, the number of different actions increased to it highest point, then decreased to an average of 3.3 different actions per min. Returning to baseline resulted in a decrease in the number of different actions and variable responding (range 0.6 – 1.6 per min). The following attention condition resulted in an immediate increase in the number of different actions, averaging 4.3 actions per min. The number of different actions remained stable throughout the remainder of the condition.

The results for the pyramid are displayed in the middle graph. In the baseline condition, the number of different actions was variable with a range of 0.6 to 1.4 responses per min. In the following Prime: Multiple condition, the number of different actions increased and stabilized at an average of 1.2 per min. The second baseline condition resulted in decreased and variable responding with the number of different actions ranging from 0.8 to 1.4 per min. In the attention condition, the number of different actions sharply increased, followed by a decreasing trend. With the final data point higher than any previous data point in any prior condition, the average number of different actions in the attention condition was 2.6 actions per min. Returning to the final baseline condition, the number of different actions became variable, with a range of 0.8 to 2.2 responses per min. The following attention condition resulted in an increase in the number of different actions (average of 3.1 responses per min).

Baseline with the pirate ship (bottom graph) shows stable responding with an average of 1.7 different actions per min. In the Prime: Multiple condition, responding was similar to the previous baseline conditions, with an average of 2 different actions per min. The second baseline condition showed a decreasing trend, averaging 1.3 different actions per min. In the attention condition, responding immediately increased to an average of 4.6 different actions per min. Returning to the baseline condition, the number of different actions decreased and became variable, with responding ranging from 0 to 2.2 per min. In the attention condition the number of different actions increased to an average of 2.6 per min.

Figure 7 displays the results of the number of different actions across Set 2. The numbers of different actions emitted with the Robin Hood Forest ™ are displayed in the top graph. In the baseline condition, the number of different actions remained variable with the number of actions ranging from 0.6 to 2 per min. In the attention condition the number of different actions immediately increased. On session 43, a sharp decrease occurred, but was then followed by an increasing trend throughout the remainder of the study. The average number of different actions in this condition was 2.5 per min.

The middle graph shows the number of different actions with the Main Street™. During baseline, responding was initially variable, but stabilized during sessions 14-36 (average of 1.7 different actions per min). In the attention condition, responding increased and stabilized at an average of 2.7 different actins per min.

The bottom graph displays the results for the castle. The numbers of different actions were variable throughout the baseline condition (range 1 – 2.6 per min). The attention condition showed an immediate increase in the number of different actions. Responding remained variable in this condition, with the number of different actions ranging from 1.8 – 4 per min.

Figure 8 displays the percentage of intervals with engagement results for Set 1. The ordinate displays percentages for each material and consecutive sessions are displayed on the abscissa. The top graph of Figure 8 displays the percentage of intervals with engagement with the dollhouse. During baseline,

percentage of intervals with engagement initially remained constant at high levels, then decreased across the last three sessions. Engagement with the dollhouse occurred 88.3% of the intervals. In the Prime: Single condition, engagement dropped to zero across all sessions. Implementing the Prime: Multiple condition increased engagement initially, but engagement decreased in the last session (average 93.3% of intervals with engagement). In the following baseline condition, the percentage of intervals with engagement initially decreased, however the percentage of engagement increased throughout the remainder of the baseline condition (average 67.7% of intervals with engagement). In the attention condition, the percentages of intervals with engagement immediately increased to and remained constant at 100% throughout the phase. Returning to baseline conditions resulted in a significant decrease throughout the majority of the sessions (average 43.4% of intervals with engaged) followed by an increase on the last session. In the attention condition, intervals of engagement increased to 100% and remained constant throughout the remainder of the condition.

The middle graph displays the percentage of the percentage of intervals with engagement with the pyramid. In the baseline condition, the percentages of intervals with engagement remained stable at high levels, with an of 86.2% intervals engaged. In the Prime: Multiple condition, responding maintained at high levels, with an average of 96.6% of intervals with engagement. Returning to a second baseline condition resulted variable responding with a range of 53.3% to 86.6% of intervals with engagement. In the attention condition, the percentages

of intervals with engagement increased to an average of 96.6%. The third baseline condition resulted in variable engagement, averaging 93.2% (range, 83% – 100%)of intervals with engagement. In the following attention condition, response patterns were similar to the previous condition (averaging 93.2% of intervals with engagement).

. The bottom graph displays the results of the percentage of intervals with engagement with the pirate ship. Responding was variable during baseline conditions, with a range of 0 to 86.6% of intervals with engagement. In the Prime: Multiple condition, percentage of intervals engaged increased and averaged 91.7%. Returning to the second baseline resulted in variable engagement intervals, averaging 74.1% (range, 53% - 86%). In the attention condition, percentages of intervals engaged increased and maintained at high levels throughout the phase (average 98.9%). The third baseline showed variable responding, with average of 45.7% of intervals with engagement. In the following attention condition, the intervals with engagement initially increased, but then decreased throughout the remainder for the condition (average 81.1% of intervals with engagement).

Figure 9 displays the results for the percentage of intervals with engagement with the materials in set 2. The data is presented in the same manner as Figure 8. The top graph display the results with Robin Hood Forest™. In the baseline condition, the percentages of intervals engaged varied with ranges of 13% to 100%. In the attention condition, the percentages of intervals engaged

were stable with the exception of a decrease in session 42 (averaging 96.1% of intervals with engagement).

The middle graph displays the engagement results with the Main Street™. The percentages of intervals with engagement were variable across baseline conditions (range of 66% - 100%). In the attention condition, the percentages of intervals with engagement remained variable at higher levels (range, 83.3% to 96.6%).

The bottom graph displays the results of the intervals engaged with the castle. In the baseline condition, the percentages of intervals with engagement were variable (ranging from 10% to 100%). In the attention condition, the percentages of intervals engaged were stable at high levels, with the exception of a decrease of intervals engaged in session 43 (averaging 92.8% of intervals with engagement).

Figure 10 shows the percentages of different play episodes with the materials in Set 1. For each session, the number of different play episodes was divided into the total number of play episodes to obtain a percentage of different play episodes. The top graph displays the results with the dollhouse. In the baseline condition, the percentage of different play episodes was variable (range, 10% to 57%), with an average of 15%. In the Prime: Single condition, the percentages of different play episodes decreased and remained constant at 0%. In the Prime: Multiple condition, the percentages of different play episodes were higher and more variable than the previous condition (average of 61%). In the

second baseline condition, the percentage of different play episodes became stable and averaged 50%. In the following attention condition, the percentages of different play episodes increased to an average of 58%. In the third baseline condition, the percentages of different play episodes dropped and became more variable with ranges of 6% to 50%. In the second attention condition, the percentages of different play episodes increased to an average of 67%.

The middle graph shows the results of the percentage of different play episodes with the pyramid. In the baseline condition, the percentages of different play episodes were variable with ranges of 11% to 38%. In the Prime: Multiple condition, the percentages of different play episodes were initially stable, then increased in the last session, averaging 32%. In the second baseline condition, the data show a decreasing trend, with the percentage of different play episodes averaging 34%. In the attention condition, the percentages of different play episodes were variable, averaging 41%. In the third baseline, the data show initial variability, then stabilized (average of 29% of different play episodes). In the attention condition, the percentages of different play episodes immediately increased to an average of 62%.

The bottom graph shows the results of the percentage of different play episodes with the pirate ship. In the baseline condition, the percentages of different play episodes were stable, with the exception of a decrease in the last session (average of 36% of different play episodes). In the Prime: Multiple condition, the percentages of different play episodes were on an increasing trend,

with the exception of a decrease in the last session (average of 41%). In the second baseline condition, responding initially increased, then decreased throughout the remainder of the phase, with the percentage of different play episodes averaging 43%. In the attention condition, the percentages of different play episodes immediately increased and stabilized at an average of 79%. In the third baseline, the data show variability, with the percentages of different play episodes ranging from 3% to 68%. In the attention condition, the percentages of different play episodes immediately increased, then decreased throughout the remainder of the phase (average of 67%).

Figure 11 shows the percentages of different play episodes with the materials in Set 2. The data are presented in the same manner as Figure 10. The top graph displays the results with Robin Hood Forest. In the baseline condition, the percentages of different play episodes were variable, averaging 28% (range of 6% - 58%). In the following attention condition, the percentages of different play episodes remained variable, at higher levels, averaging 42% (range of 25% - 69%).

The middle graph displays the results with Main Street. In the baseline condition, the percentages of different play episodes were initially stable, then coinciding with the Prime: Single condition, the percentages increased and became variable, only to again decrease and remain variable throughout the remainder of the baseline condition. The average in this condition was 28% of different play episodes. In the following attention condition, the percentages of

different play episodes initially increased, but then decreased in the last three sessions (average of 51%).

The bottom graph displays the results with castle. In the baseline condition, the percentages of different play episodes were initially stable, then coinciding with the Prime: Single condition, the percentages increased, only to again decrease and remain variable throughout the remainder of the baseline condition (average of 32%; range of 6%-60%). In the attention condition, the percentages of different play episodes remained variable, at higher levels, averaging 50% (range of 33% - 69%).

DISCUSSION

This study examined the effects of priming and contingent attention on novel play episodes. The results of this study showed that substantial gains did not occur under priming conditions; however, under contingent attention conditions, increases in the number of novel play episodes, number of different play episodes, and the number of actions occurred across both sets of stimuli occurred. Generalization was not observed across materials with the measures employed.

In the Prime: Single condition, no play responses to the dollhouse were observed. This may have occurred due to: (a) satiation (repeated exposure to same material within a relatively short period of time), (b) attention (attention was removed during probe sessions), or (b) extinction or punishment (repetitive responses were blocked during training). To address the hypothesis that satiation may have been responsible for the lack of responding, the intervention was applied to multiple materials, which were presented in a rotating fashion. During the Prime: Multiple condition, play responses with the dollhouse initially showed increases across all measures, but then decreased throughout the remainder of the condition. With the remaining materials in Set 1, the number of novel responses, play episodes, different actions and the percentage of intervals with engagement all remained similar to the previous baseline condition. Set 2 showed some increases in novel responding while Set 1 was under the priming conditions, but it is not clear if these changes could be attributed to the intervention alone.

Due to the lack of change in both priming conditions, the investigator reviewed the videotapes of the previous sessions. Informal observations suggested that an increase in the number of times the child requested attention had occurred. Positive social attention was then made contingent on novel play episodes. When this contingency was applied to both sets of materials, dramatic increases occurred in novel play episodes, number of different episodes, and the number of different actions. The results obtained for total and different play episodes showed that both sets resulted in increased variability.

A comparison of the percentage of intervals engaged across other measures (rate of play episodes, rate of different actions, and the number of novel responses) demonstrates that applying the attention contingency had a positive impact on engagement despite the fact that there were no direct contingencies for engagement. This may be important information for children with autism who spend little time engaged in appropriate activities.

Session 43 shows a marked decrease across all the number of play episodes and percentage of intervals with engagement with the pirate ship and Robin Hood's Forest™. Anecdotally, the parents of the child informed the investigator that the subject had consumed food not included in his gluten and casein-free diet earlier that day. For this reason, two additional sessions were conducted to determine whether the dietary change was responsible for the decreased responding. Because the responding was markedly different only on that day, the diet change may have been responsible for the change in behavior.

Although increased variability was observed across all materials, there are differences between Set 1 and Set 2. This is evident by the percentages of different play episodes with Set 1 and Set 2 (see figure 10 and 11). The overall average of different play episodes with Set 1 was 62%, while the overall average for Set 2 was 47%. This difference may have been a result of the prior priming conditions in Set 1. The priming procedure utilized a component in which the investigator blocked repetitive responses. Although it is unclear what function the blocking procedure served (i.e., extinction or punishment), it is reasonable to assume that while repetitive responses were blocked in Set 1, repetitive responses continued to occur across several sessions with Set 2. A longer history of repetitive responses may have accounted for the differences seen between the two sets.

Probes for generalization were conducted across materials. The data indicate that generalized variability did not occur across materials, or across conditions. Although variability did not generalize, it is possible that specific responses may have generalized across materials. Referring to the play data sheets, the investigator identified responses that initially occurred only with some materials in Set 1, but later occurred with Set 2 materials during attention conditions. For example, while the subject was engaging with the pyramid (Set 1) he often placed a character on a trap door, pushed it down, and commented, "He fell in". During session 45, the subject emitted a similar response with the Robin Hood Forest™ (Set 2) by placing a character on the bridge, pushing him down,

and commenting, “He fell in”. These findings advance the literature and warrant further analysis.

It is unclear if the previous literature regarding play variability (Goetz & Baer, 1973; Lalli, et., al., 1994) identified stereotypical responses prior to intervention. The participant in this study engaged in highly stereotypical responding prior to the intervention. As can be seen by the percentage of different play episodes, repetitive responding decreased under the attention conditions.

An analysis of the different interventions in Set 1 shows a marked change between baseline and contingent attentions conditions across novel, total, and different play episodes. This could be interpreted as a result of not only the attention provided contingent on novel episodes, but also perhaps a function of the proximity of the investigator. This distance might have been a discriminative stimulus for variable responding. If this is true, then it may support previous literature demonstrating that behavioral variability can be controlled by discriminative stimuli (Denney, & Neuringer, 1998). Further investigations are warranted demonstrating the effects of a discriminative stimulus on variable play skills.

To summarize, this study demonstrates that attention contingent on variable responding can generate variability. It extends the literature in several ways. First, this study was implemented with a child with autism, rather than a typical child (Goetz & Baer, 1973), or with a child with developmental disabilities

(Lalli et. al., 1994). The child with autism engaged in stereotypical prior to the study and seldom varied his play responses. The contingent attention phase increased variability and decreased repetitive responding. Second, exposure to the priming procedure appears may have affected responding in the attention condition. The blocking component, which blocked repetitive responses, may have been a factor for the overall increase in the percentages of different play episodes. This information would contradict Neuringer, et. al., (2000), in which extinction decreased variable responding. Third, the current research sought to assess generalization across materials. This was not done in any of the studies on play variability. Although it was determined that generalized variability across materials did not occur, this provides additional information for future studies. Fourth, attention was delivered only following novel play episodes (those which had never occurred with a targeted material). It is important to note that throughout the study, the child emitted close to 100 novel responses with each material, a total of over 590 new responses across 52 sessions. This can be contrasted with Lalli et. al., (1994) in which an average of 15 responses were generated across an average of 19 sessions. Fifth, a reversal to baseline was conducted in this study. Lalli et. al., (1994) conducted an A-B design, so it was unknown if responding maintained once the contingencies were removed. Rather than reversing to baseline conditions, Goetz & Baer (1973), reinforced repetitive responding. Due to the initial perseverative responses of the participant in this study, and the nature of his diagnosis, the investigator determined that it was not

in the best interest of the child to reinforce those behaviors. Reversals to baseline were conducted to assess generality across conditions. Finally, unlike Hardiman et. al., (1975), the priming procedures did not appear to produce any significant different in varied responses. Priming may be a procedure that only is effective in teaching specific response topographies.

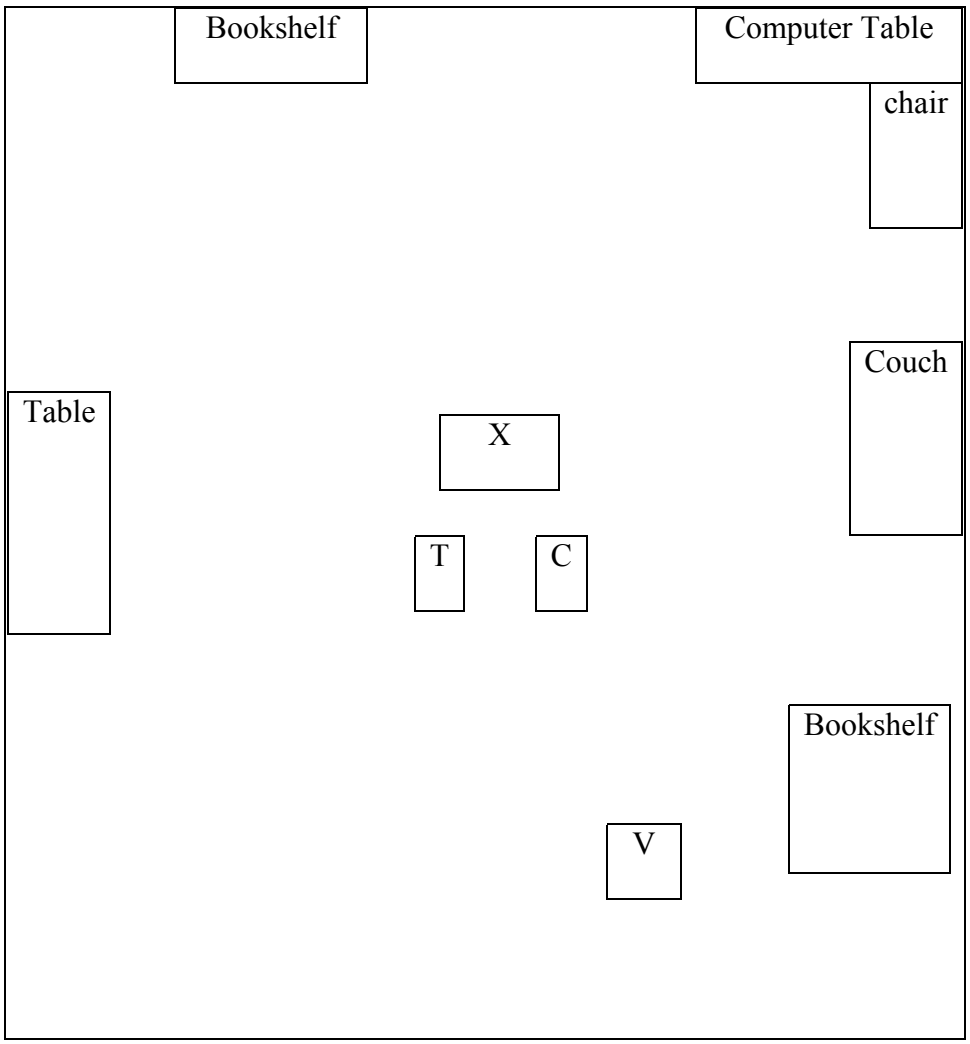
Although this study provides important information, and extends the literature, future studies are in order. First, collateral measures should be employed to identify additional behaviors that may be manipulated as a consequence of reinforcing variable responding. For example, an assessment of language skills (i.e. length of utterances, varying topics, etc.) could be administered prior to, and during and following variability training with play materials. Second, because variable responding did not generalize, additional research is necessary to develop procedures to generate variability across responses, materials, and time. Third, this procedure could be extended to include fading the presence of the teacher. This would involve transferring stimulus control from the teacher directly to the play materials. Thinning the schedule of reinforcement or systematically increasing the distance between the teacher and the participant may aid in the transfer of stimulus control. Finally, social play responses could be studied in similar ways. Applying attention contingencies to such social behaviors (i.e., initiations, engagement, language) may affect peer interactions. This information would be beneficial to increase joint play interactions.

In conclusion, this research is the first clear demonstration that contingent attention can produce significant increases in the novel play responses of children with autism. It also demonstrates that repetitive responding can be decreased when variability is reinforced, and suggests that an increase in variability has a positive effect on engagement. This study opens the door to several further investigations regarding this important area.

APPENDIX A

ROOM DESIGN

ROOM DIAGRAM



X Material

T Investigator

C Child

V Video Camera

APPENDIX B

OBSERVATION CODE, BEHAVIORAL DEFINITIONS, AND DATA SHEETS

OBSERVATION CODE AND PROTOCOL

Data will be collected via videotape with each segment lasting 5m. Before collecting data on play episodes, the observer should first view the segment in its entirety. Following the first viewing, the observer again views the tape this time writing down each play sequence as it occurs (this will involve pausing the video after each play sequence). The third viewing involves the observer filling in the corresponding box in a sequential manner (see data collection example).

Components that make up the play sequence will be noted on the left side of the boxes. These components are: object, action, and location. "Object" is the material in which the subject has primary contact with. "Action" is what the subject does with that object. "Location" is the object's ending placement.

Examples of Play Episodes:

(1) The subject flips the character off the tree stump towards the cast

Object(s)	Action	Location
Character; tree stump	*flips*	*castle*

(2) The subject picks up a character and has him run to the tree.

Object(s)	Action	Location
Character	*runs*	*tree*

(3) The subject picks up a character, puts the character on the limb and swings the limb.

Object(s)	Action	Location
Character; limb	*swings*	*

(4) Subject places the cannon in front of the door and shoots the ball from the cannon.

Object(s)	Action	Location
Cannon; ball	*shoots*	*door*

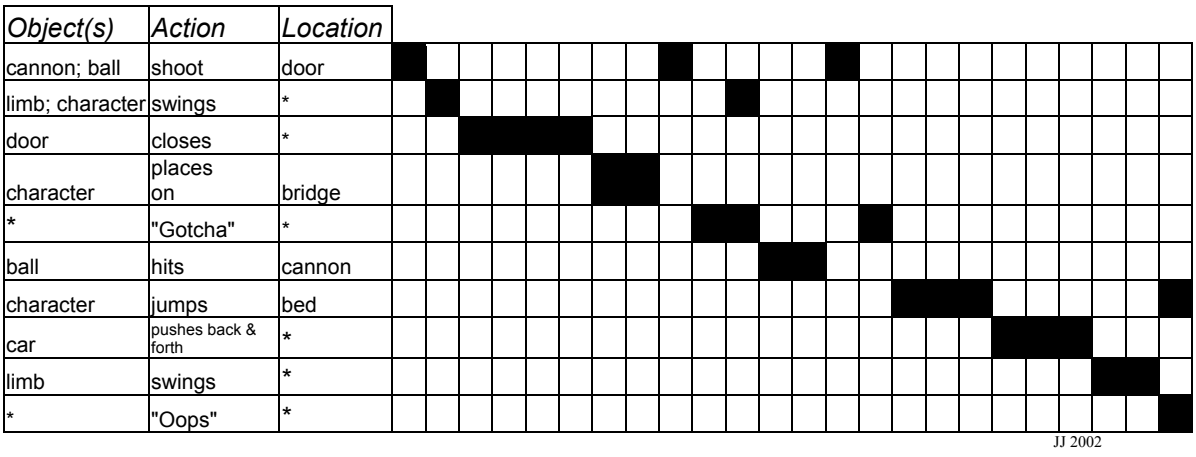
Nonexample:

(1) The subject picks up a snake and puts it back down.

Object(s)	Action	Location
Snake	*puts down*	*

When a response meets the definition of a play verbalization, then that verbalization will be noted as an action. If the verbalization occurs simultaneously with an action, then both the verbalization and the action boxes will be filled in the same column. If the verbalization occurs independent of a play action, then only the box that corresponds with that verbalization will be filled in. (See data collection example below)

Example of Data Collection:



BEHAVIORAL DEFINITIONS FOR PLAY CODE

Play Actions are defined as what the participant does with an object or set of objects. Play Actions can consist of the subject throwing, pushing, or hitting an object with his hand.

Examples: Pushing (a car, a man, a truck); banging (a drum); moving (a character, a launcher).

Nonexamples: Repeatedly shaking an object in front of his face; holding and object for 3s or longer without an accompanying action.

Objects are defined as any and all materials associated with play apparatus with which the subject contacts.

Examples: Cannonball; launcher; characters.

Location was defined as an object's ending placement.

Examples: A Bridge; water; tree.

Play episodes are defined as sequences comprised of an object or set of objects, action, and location. An episode begins when the subject touches an object with his hand that is then followed by an action. An episodes ends when (1) a new action begins, (2) when three seconds elapse following an action, (3) when the subject's hands/fingers are taken off an object, or (4) when the object has reached its original starting point.

Examples of play episodes:

(1) Subject places the cannon (*object*) in front of the door (*location*) and shoots (*actions*) the ball (*object*) from the cannon.

(2) The subject picks up a character (*object*) and has the character run (*action*) to the tree *(location*).

(3) The subject swings *(action*) the limb (*object*).

Nonexample:

(1) Picking up an object and putting it down without an action between these two behaviors.

Play Verbalizations are defined as vocalizations emitted while playing with materials. This can be any utterance, word, or phrase in the form of a request, comment, or protest that are related to the materials with which the subject is manipulating. *Phrases* are defined as two or more words emitted consecutively by the subject. Examples include the following: While holding a cup to the character's mouth, the subject says, "Do you want some milk?" (Request); The subject puts a cookie to the characters mouth and says, "That was yummy!" (comment); The subject takes a character, knocks down another character, and says "Stop that!" (protest). *Words* are defined as singular formed utterances emitted by the subject such as "Crash", "Cool", and "Mine". *Utterances* are sounds emitted by the subject that are related to the current action taking place within the theme and are not words. Examples include the following: The subject moves a car and says "Ch ch ch"; The subject shoots a cannonball and says "Ahhh!"; Exclusions to play verbalizations include any comments or requests made towards the teacher such as the subject turning towards the teacher and saying "Can I have a cookie?" or "Look at this". Another exclusion to play verbalizations is if the subject emits unrelated verbalizations to a play action(s) currently taking place such as the subject pushing a snake and singing "Twinkle twinkle little star".

PLAY EPISODE DATA SHEET

Material:____ Condition:____ Session #:____ Date of Session:_____ Observer Name & Date:_____

Object(s)	Action	Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Different Objects:_____ # Different Actions:_____ # Different Locations:____ # New Locations_____

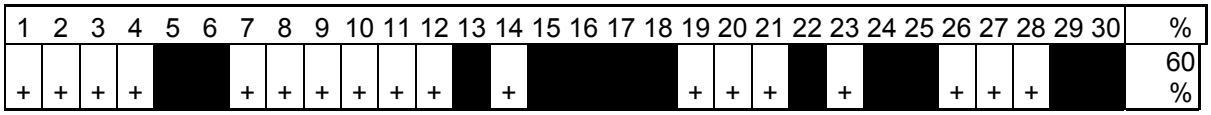
Requests for Attention:_____ Total # Play Episodes:_____ # Different Play Episodes:_____

Novel Episodes:_____

JJ 2002

BEHAVIORAL DEFINITIONS AND DATA COLLECTION PROTOCOL FOR ENGAGEMENT

The engagement data will be collected via a 10 s partial interval. Each 5-min segment will be divided into thirty 10 s intervals. During each 10s interval, the recorder will note if the subject is or is not engaged with the play materials. If a play action and/or verbalization occurs anytime within this 10 s interval, a plus sign will be placed in the corresponding interval box. If a play action and/or verbalization does not occur, the corresponding box will be completely filled in. A percentage of the time engaged with the materials will be noted to the right of the boxes and will be derived by dividing the number of intervals engaged by the total number of engagement intervals. (See example below)



Engagement is defined as any play action and/or play verbalization that occurs within an interval.

Examples: The subject pushes a car, moves a character, or opens a door. The subject moves a character up the stairs. The subject pushes a car and verbalizes "Here I come!".

Non-engagement is defined as any time the subject is not emitting a play action or verbalization.

Examples: Mouthing toys, facing away from the materials and not manipulating any of the objects, holding a toy without an accompanying action, and vocalizing non-thematic related phrases, songs, etc.

ENGAGEMENT DATA SHEET

Engagement Data ***10s partial Interval***

Date of session:_____ Session Number:_____

Observer:_____ Date of observation:_____

KEY:	+	Engaged
		Not Engaged

Condition: Material:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
															% Engaged
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	____

Condition: Material:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
															% Engaged
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	____

Condition: Material:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
															% Engaged
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	____

JJ 2002

APPENDIX C

TABLES

			Percentage of Agreement							
Session	Material	Condition	# Different Objects	# Different Actions	# Different Locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged
1	Main Street	BL	100	90	98	92	100	100	96	96
1	Pyramid	BL	100	100	83	85	100	96	86	100
6	Dollhouse	BL	100	96	100	96	66	100	100	100
6	Pirate Ship	BL	90	86	80	97	100	83	87	93
14	R. H. Forest	BL	100	93	100	89	75	98	98	96
15	Castle	BL	100	100	100	96	100	100	94	100
19	Pyramid	PROBE	100	86	50	100	75	100	100	96
21	Castle	BL	75	100	83	91	100	100	86	100
24	Dollhouse	PROBE	87	100	100	85	100	100	91	93
30	R.H. Forest	BL	100	96	100	98	50	100	89	100
32	Pirate Ship	CONT.. ATTN.	92	93	100	100	100	100	100	100
33	Pyramid	CONT. ATTN.	88	96	100	92	100	88	92	100
38	Main Street	CONT. ATTN.	100	88	100	91	93	93	100	96
42	Castle	CONT. ATTN.	100	95	100	98	75	90	96	100
AVERAGE PERCENTAGE OF AGREEMENT			**95**	**94**	**92**	**94**	**88**	**96**	**94**	**98**

Table 1. Interobserver Agreement.

Session	Materials			
1	A	B	C	
2	D	E	F	
3	E	A	B	
4	F	D	C	
5	D	C	A	
6	B	F	E	
7	A	B	D	
8	C	E	F	
9	D	F	A	
10	B	C	E	
11	F	A	D	
12	C	E	B	
13	F	E	D	F
14	B	A	C	
15	F	A	E	F
16	F	D	C	F
17	E	F	A	
18	B	C	E	
19	A	C	D	
20	B	D	F	
21	C	B	E	
22	E	B	F	
23	A	E	C	
24	D	B	F	
25	E	F	B	

Session	Materials		
26	A	D	E
27	F	B	C
28	B	C	A
29	D	F	E
30	C	A	B
31	E	D	F
32	C	B	A
33	B	D	E
34	E	F	D
35	C	A	B
36	E	C	D
37	F	B	A
38	B	A	C
39	D	E	F
40	D	A	B
41	E	F	C
42	B	C	D
43	F	E	A
44	D	B	C
45	A	F	E
46	C	D	F
47	B	E	A
48	C	F	B
49	A	C	D
50	E	B	F
51	D	E	F
52	A	F	B

Key:	
Robin Hood Forest	A
Pyramid	B
Main Street	C
Castle	D
Pirate Ship	E
Dollhouse	F

Table 2. Order of presentation

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
2	BL	4	4	1	N/A	86	12	N/A	9	100%	0
4	BL	4	4	3	2	52	7	3	6	100%	0
6	BL	3	4	1	0	32	2	0	6	100%	*
8	BL	3	6	1	0	70	10	2	7	90%	*
9	BL	3	3	2	0	30	3	1	6	83%	0
11	BL	4	4	1	0	14	1	0	8	56.6%	*
13	PRIME SINGLE	4	8	9	4	31	0	3	13	100%	*
13	PROBE	0	0	0	0	0	0	0	0	0%	6
15	PRIME SINGLE	6	19	9	1	47	0	13	28	100%	*
15	PROBE	0	0	0	0	0	0	0	0	0%	4
16	PRIME SINGLE	7	26	7	1	48	1	12	31	100%	*
16	PROBE	0	0	0	0	0	0	0	0	0%	5
17	PRIME MULT.	8	11	3	2	38	2	11	19	100%	*
19	PROBE	5	11	8	1	26	0	9	20	100%	*
21	PROBE	7	9	4	0	32	1	4	14	100%	*
22	PRIME MULT.	8	21	9	0	39	1	11	32	100%	4
24	PRIME MULT.	8	24	10	2	40	0	12	33	100	2
25	PROBE.	6	4	6	2	17	0	2	11	80	*
27	BL	5	6	2	0	18	1	1	10	50%	2
29	BL	5	4	4	0	21	1	2	10	73.3%	*
31	BL	4	5	3	0	19	2	0	9	83%	*
32	Cont. Attn.	7	20	7	3	49	3	9	26	100%	*
34	Cont. Attn.	9	16	10	2	47	4	15	30	100%	*
35	Cont. Attn.	9	13	5	1	37	3	7	21	100%	*
39	BL	5	8	2	0	27	3	1	12	66.6%	5
41	BL	1	3	0	0	47	7	1	3	56.6	1
43	BL	4	5	2	0	14	1	2	6	26%	7
45	BL	2	3	0	0	27	3	0	3	10%	3
46	BL	5	6	4	0	20	0	2	10	56%	3
48	Cont. Attn.	4	19	6	0	43	0	10	21	100%	*
51	Cont. Attn.	8	23	11	0	43	1	17	33	100%	4
52	Cont. Attn.	6	22	10	0	38	0	9	29	100%	*

Table 3. Data Summary for Dollhouse (Set 1). Asterisks indicated data unavailable for that session.

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
1	BL	2	3	1	1	48	8	N/A	3	46	0
3	BL	4	8	2	2	29	2	7	10	93.3	*
5	BL	3	5	0	0	11	2	0	5	13	6
7	BL	5	9	3	1	30	3	5	10	100	*
9	BL	4	7	3	2	17	0	3	10	96.6	0
11	BL	4	10	4	0	23	0	0	10	80	*
14	BL	3	4	5	1	29	0	9	9	96.6	6
15	BL	4	5	4	6	32	0	4	8	90	*
17	BL	7	8	7	2	35	1	9	15	96.6	3
20	BL	3	6	5	0	26	1	0	8	93.3	*
23	BL	4	7	4	0	61	14	5	9	100	*
26	BL	6	10	5	0	63	7	1	14	100	*
28	BL	6	7	6	1	27	1	2	16	83.3	4
30	BL	2	6	5	0	39	2	0	9	76.6	*
33	BL	2	4	5	0	51	4	0	13	96.6	*
35	BL	2	5	3	0	39	2	2	9	90	3
37	BL	2	4	3	0	48	3	0	10	83.3	*
38	CONT. ATTN.	7	11	6	1	63	9	10	19	100	*
40	CONT. ATTN.	9	18	7	1	55	4	8	27	100	6
43	CONT. ATTN.	4	5	4	0	31	3	2	8	76	10
45	CONT. ATTN.	8	10	8	0	52	2	10	25	100	*
47	CONT. ATTN.	4	13	7	1	68	9	9	21	100	2
49	CONT. ATTN.	3	15	5	0	48	3	7	20	96.6	*
52	CONT. ATTN.	6	17	7	0	51	1	7	35	100	*

Table 4. Data Summary for Pirate Ship (Set 1). Asterisks indicated data unavailable for that session.

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
2	BL	6	9	3	N/A	32	0	N/A	12	40	*
3	BL	10	9	4	1	51	1	11	17	93.3	0
6	BL	9	7	5	2	37	4	6	14	100	0
8	BL	6	11	2	0	51	5	5	15	100	*
10	BL	8	9	3	0	39	2	0	16	70	*
12	BL	8	8	1	0	34	2	1	14	73.3	*
13	BL	6	7	1	0	20	1	0	10	46.6	0
16	BL	1	7	1	1	28	1	7	8	90	*
17	PRIME MULT	11	16	7	4	20	0	13	18	100	*
18	PROBE	10	9	5	2	51	8	6	16	86.6	2
20	PRIME MULT.	6	11	5	2	12	0	4	11	100	*
21	PROBE	7	9	4	0	32	1	4	14	90	3
22	PROBE	10	13	3	2	33	1	4	16	90	*
23	PRIME MULT	7	14	8	0	30	2	6	17	100	*
25	PROBE.	7	8	4	0	30	2	2	12	100	*
26	BL	7	10	5	2	27	1	7	18	86	4
29	BL	1	6	0	0	17	3	2	6	53	5
31	BL.	2	4	1	0	21	3	1	4	83.3	*
32	CONT. ATTN.	12	14	9	1	27	0	6	21	100	*
34	CONT. ATTN.	11	21	5	0	30	3	9	24	96.6	*
36	CONT. ATTN	10	21	7	0	29	1	7	23	100	*
39	BL	7	8	2	0	19	0	0	13	46	14
41	BL	13	11	5	2	38	2	3	19	86.6	0
43	BL	0	0	0	0	0	0	0	0	0	5
45	BL	2	5	0	0	13	2	0	5	40	*
47	BL	2	3	0	0	102	37	0	3	56	0
49	CONT. ATTN.	6	17	5	0	26	1	3	20	100	*
50	CONT. ATTN.	6	10	4	1	16	0	5	12	80	10
51	CONT. ATTN.	5	12	5	2	30	1	7	16	63.3	10

Table 5. Data Summary for Pyramid (Set 1). Asterisks indicated data unavailable for that session.

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
1	BL	2	3	1	1	48	8	N/A	3	46	0
3	BL	4	8	2	2	29	2	7	10	93.3	*
5	BL	3	5	0	0	11	2	0	5	13	6
7	BL	5	9	3	1	30	3	5	10	100	*
9	BL	4	7	3	2	17	0	3	10	96.6	0
11	BL	4	10	4	0	23	0	0	10	80	*
14	BL	3	4	5	1	29	0	9	9	96.6	6
15	BL	4	5	4	6	32	0	4	8	90	*
17	BL	7	8	7	2	35	1	9	15	96.6	3
20	BL	3	6	5	0	26	1	0	8	93.3	*
23	BL	4	7	4	0	61	14	5	9	100	*
26	BL	6	10	5	0	63	7	1	14	100	*
28	BL	6	7	6	1	27	1	2	16	83.3	4
30	BL	2	6	5	0	39	2	0	9	76.6	*
33	BL	2	4	5	0	51	4	0	13	96.6	*
35	BL	2	5	3	0	39	2	2	9	90	3
37	BL	2	4	3	0	48	3	0	10	83.3	*
38	CONT. ATTN.	7	11	6	1	63	9	10	19	100	*
40	CONT. ATTN.	9	18	7	1	55	4	8	27	100	6
43	CONT. ATTN.	4	5	4	0	31	3	2	8	76	10
45	CONT. ATTN.	8	10	8	0	52	2	10	25	100	*
47	CONT. ATTN.	4	13	7	1	68	9	9	21	100	2
49	CONT. ATTN.	3	15	5	0	48	3	7	20	96.6	*
52	CONT. ATTN.	6	17	7	0	51	1	7	35	100	*

Table 6. Data summary for Robin Hood Forest™ (Set 2). Asterisks indicated data unavailable for that session.

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
1	BL	6	6	0	N/A	28	5	N/A	9	66	0
4	BL	6	8	3	3	35	5	6	12	90	*
5	BL	9	8	2	2	36	5	6	14	96	*
8	BL	8	13	0	0	39	4	5	16	83.3	*
10	BL	8	10	0	0	51	7	0	15	100	0
12	BL	3	9	2	1	23	3	7	13	90	*
14	BL	8	15	4	1	39	0	6	23	90	*
15	BL	4	5	1	0	29	4	0	7	80	1
18	BL	7	7	2	0	23	1	1	14	90	*
20	BL	5	6	2	1	38	4	1	8	83.3	0
23	BL	5	8	2	0	91	25	1	11	100	*
27	BL	5	7	1	0	54	11	0	9	76.6	*
28	BL	9	8	2	1	56	9	1	15	73.3	*
30	BL	7	9	1	1	55	9	1	12	76.6	*
33	BL	6	6	1	0	37	5	0	10	83.3	*
35	BL	7	10	1	0	64	8	1	4	66	2
36	BL	5	9	3	2	47	5	5	13	73.3	4
38	CONT. ATTN.	7	21	5	1	75	14	14	25	96.6	*
41	CONT. ATTN.	6	17	4	0	32	3	10	18	93.3	3
42	CONT. ATTN.	5	18	3	0	28	0	10	19	90	2
44	CONT. ATTN.	5	13	9	2	36	1	11	25	96.6	8
46	CONT. ATTN.	4	15	3	1	26	2	4	17	83.3	3
48	CONT. ATTN.	6	15	3	1	37	5	9	18	93.3	4
49	CONT. ATTN.	10	15	3	0	36	3	3	17	93.3	1

Table 7. Data Summary for Main Street (Set 2). Asterisks indicated data unavailable for that session.

Session #	Condition	# Different Objects	# Different Actions	# Different Locations	# New locations	# Play Episodes	# Repetitive Episodes	# Novel Episodes	# Different Play Episodes	% Engaged	Req. for Attn.
2	BL	4	8	3	N/A	21	0	N/A	9	30	6
4	BL	5	5	5	3	55	5	9	14	100	*
5	B	3	6	2	0	28	2	1	8	93.3	3
7	BL	5	8	4	1	58	5	7	17	100	*
9	BL	3	5	3	1	40	3	1	8	76.6	*
11	BL	3	7	2	0	45	2	0	10	90	0
13	BL	4	7	3	1	37	0	0	11	100	*
15	BL	4	10	7	1	46	1	4	16	93.3	1
19	BL	6	13	6	2	18	0	5	14	66.6	*
21	BL	3	5	3	0	7	0	0	6	10	*
24	BL	7	13	5	0	36	2	7	18	70	2
26	BL	6	11	5	1	43	2	7	18	83.3	*
29	BL	5	9	5	0	71	16	3	15	100	1
31	BL	4	7	4	0	58	5	0	13	96.6	*
32	BL	3	8	7	0	34	2	1	12	83.3	*
34	BL	3	7	4	0	23	0	1	10	90	2
36	BL	3	6	6	0	34	1	1	13	93.3	*
39	CONT. ATTN.	6	13	8	2	46	3	5	19	100	*
40	CONT. ATTN.	5	20	5	1	62	4	10	27	100	2
42	CONT. ATTN.	4	9	6	1	29	1	8	16	63.3	4
44	CONT. ATTN.	3	10	4	0	33	0	4	15	96.6	1
46	CONT. ATTN.	5	14	3	0	30	0	4	18	93.3	*
49	CONT. ATTN.	4	12	5	0	34	1	5	21	96.6	*
51	CONT. ATTN.	3	15	6	0	47	2	6	23	100	3

Table 8. Data Summary for Castle (Set 2). Asterisks indicated data unavailable for that session.

APPENDIX D

FIGURES

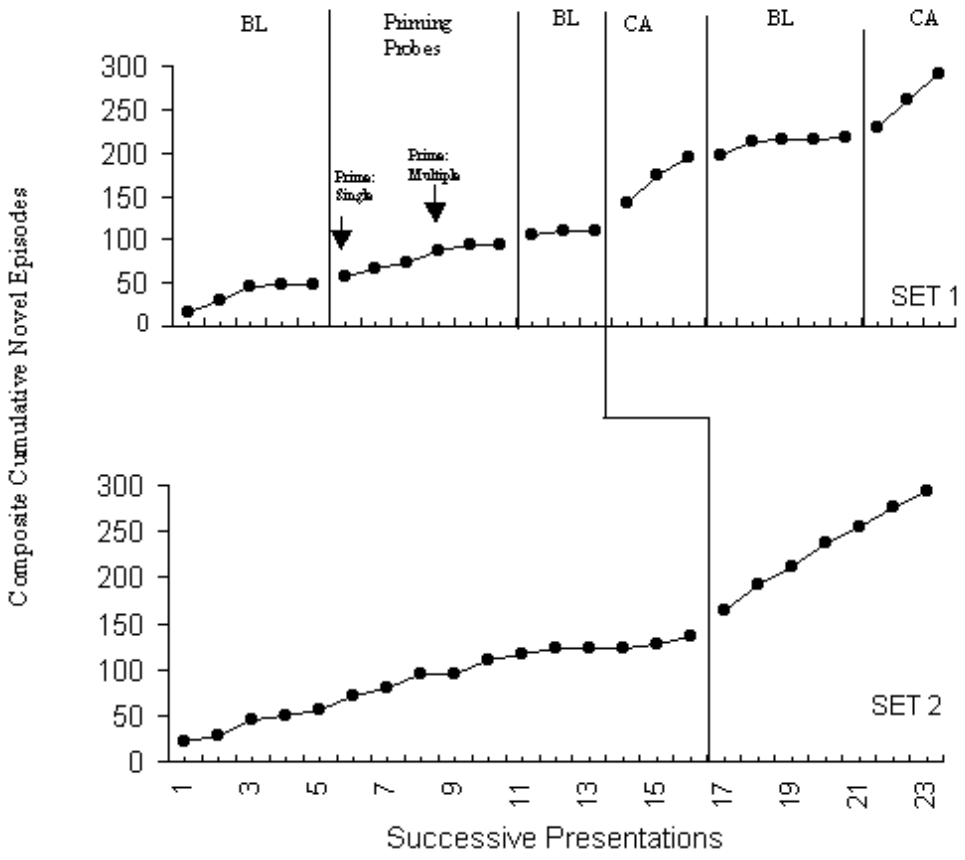


Figure 1. Composite Record of Cumulative Novel Play Episodes during baseline and intervention conditions for Set 1 (top panel) and Set 2 (bottom panel).

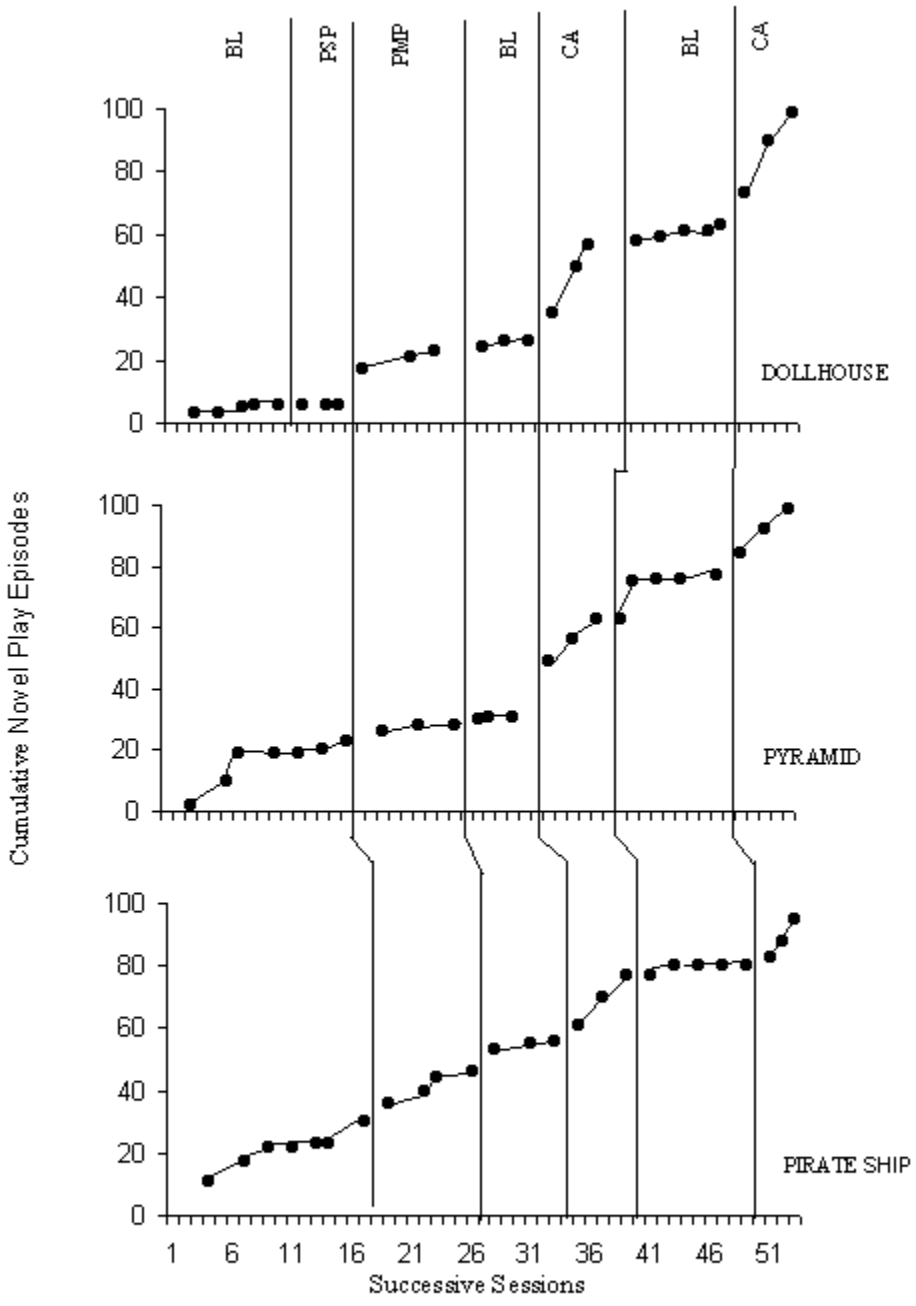


Figure 2. Cumulative number of novel play episodes across baseline (BL), Prime: Singe probes (PSP), Prime: Multiple Probes (PMP), and contingent attention (CA) conditions for Set 1.

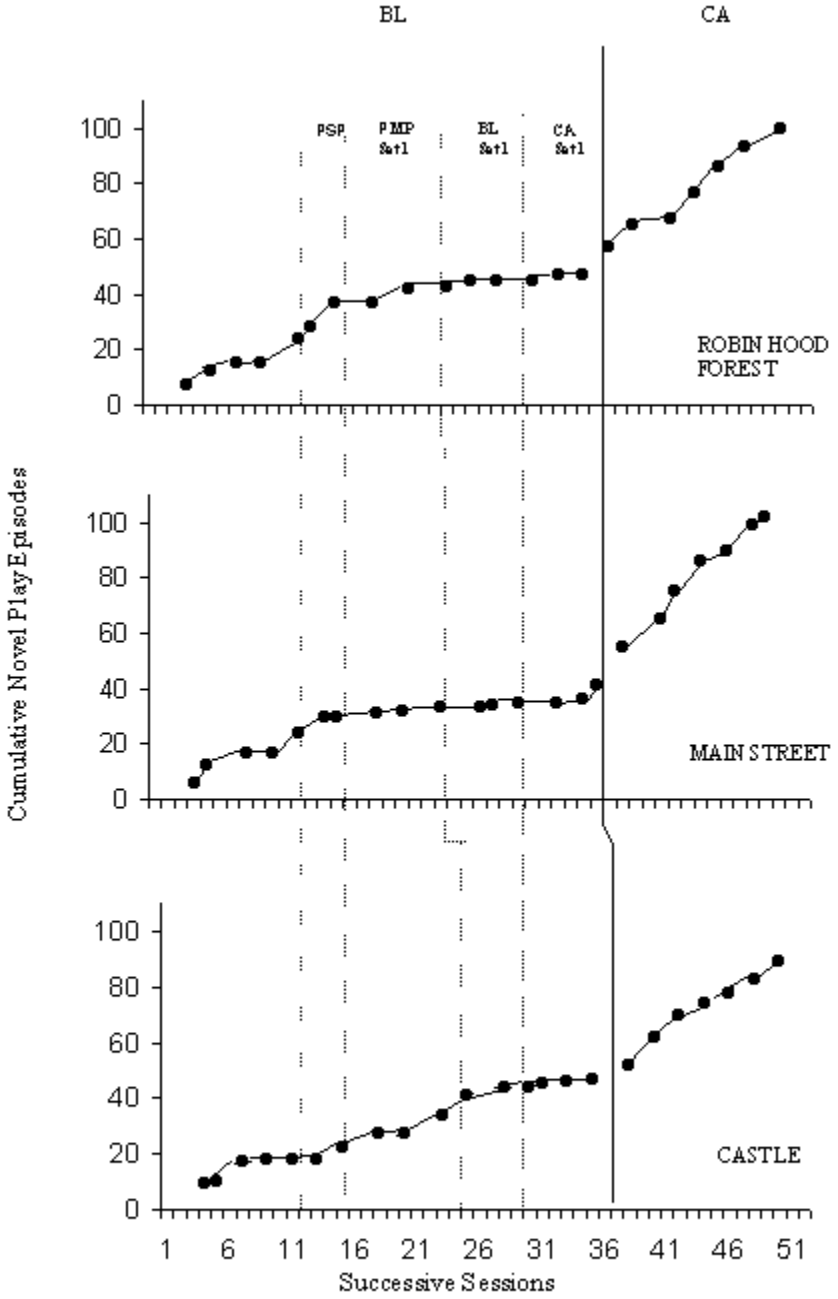


Figure 3. Cumulative number of novel play episodes across baseline (BL) and contingent attention (CA) conditions for Set 2.

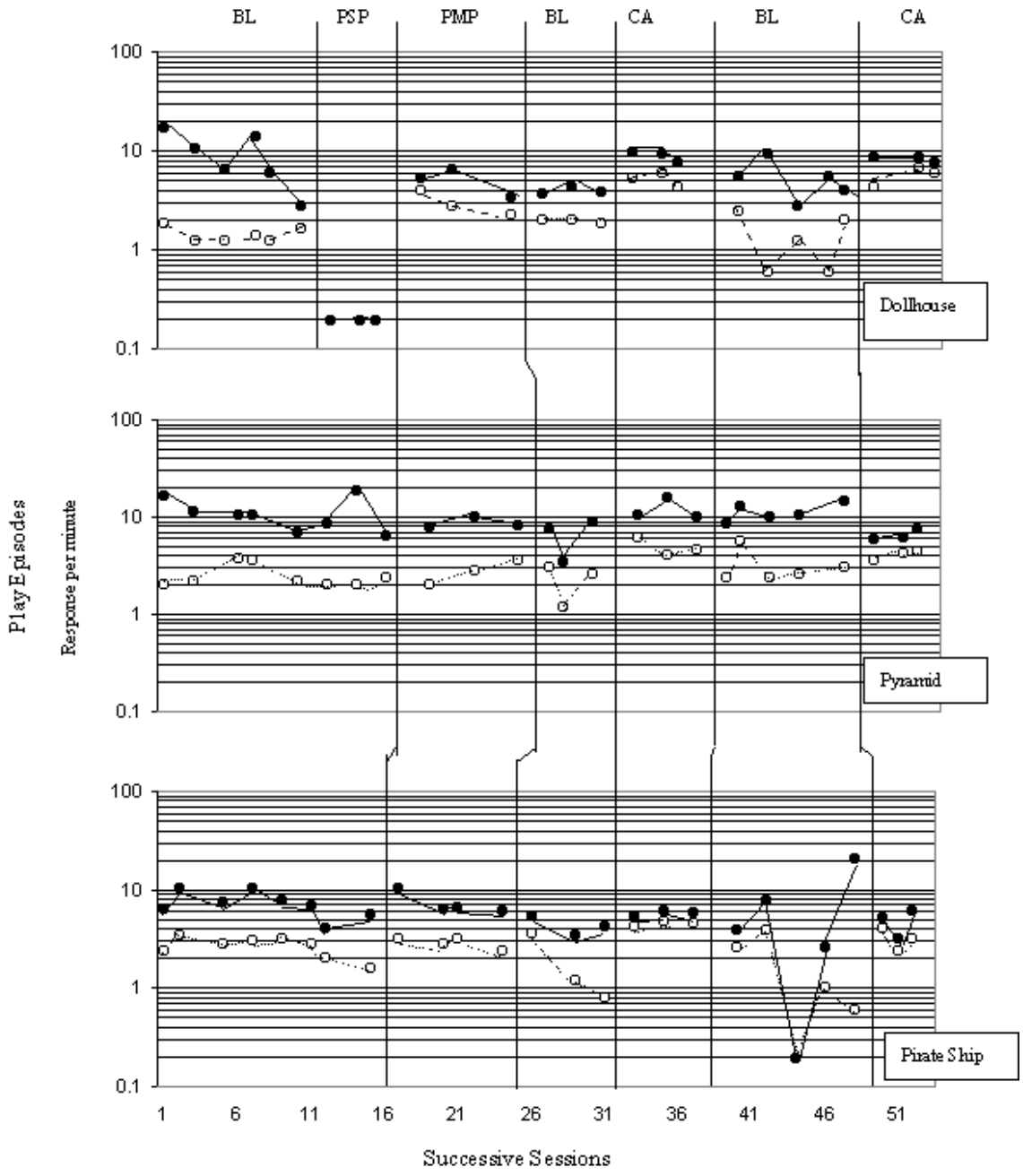


Figure 4. Rate of play episodes per minute across all conditions for Set 1. Closed circles represent total number of play episodes and open circle represent the number of different play episodes.

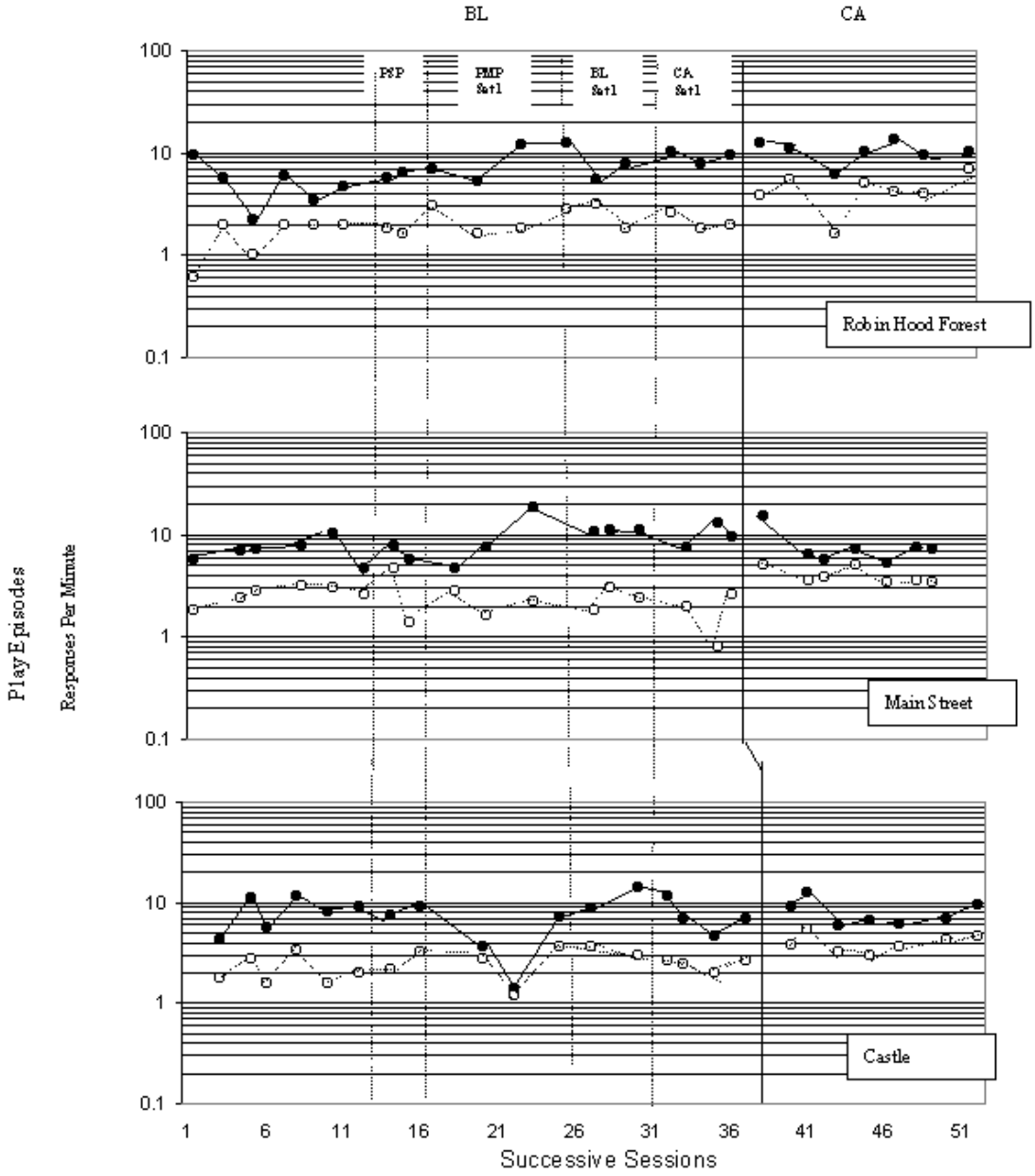


Figure 5. Rate of play episodes per minute across baseline and contingent attention conditions for Set 2. Closed circles represent total number of play episodes and open circles represent number of different play episodes.

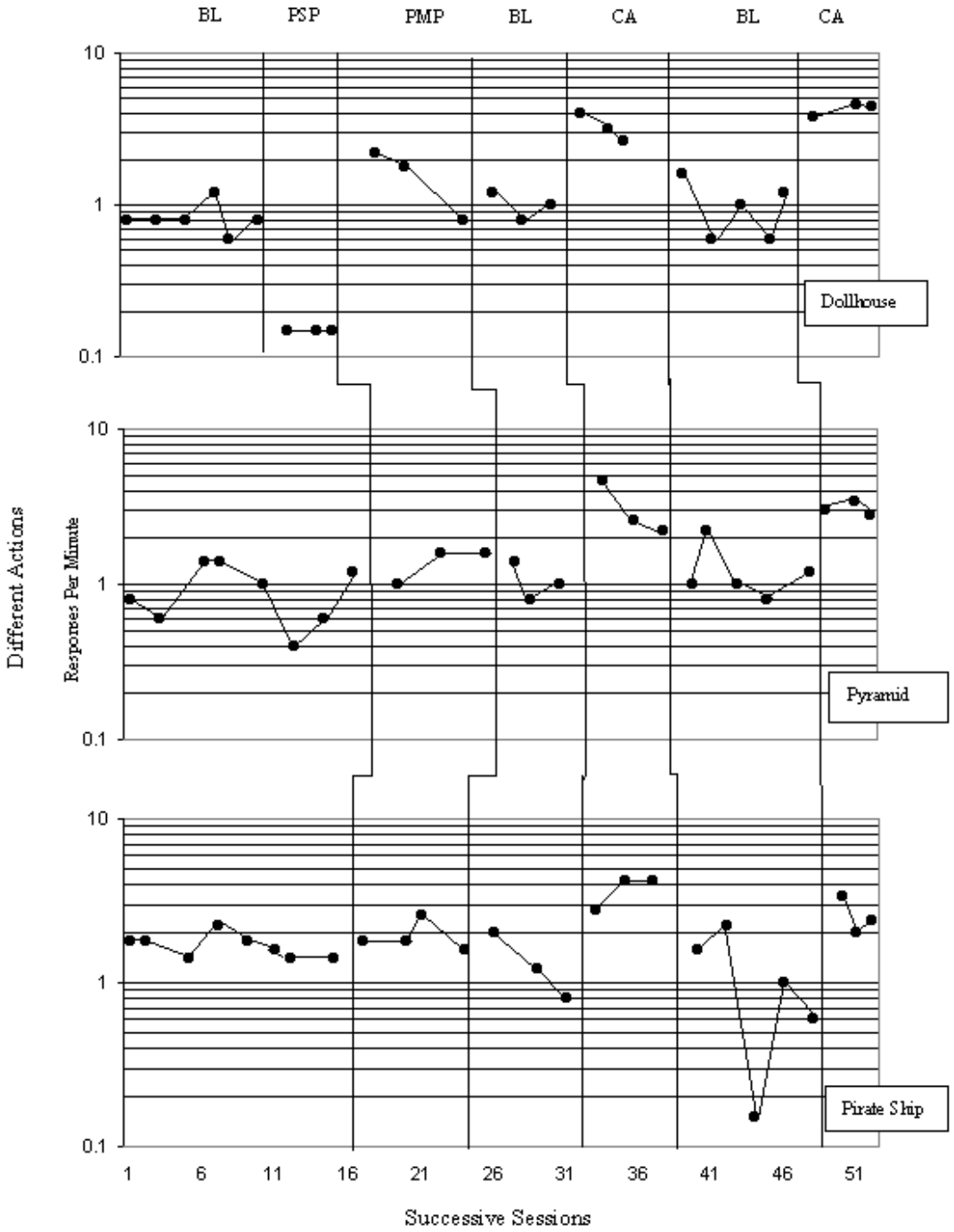


Figure 6. Rate of different actions per minute across baseline (BL), Prime: Single probes (PSP), Prime: Multiple probes (PMP), and contingent attention (CA) conditions for Set 1.

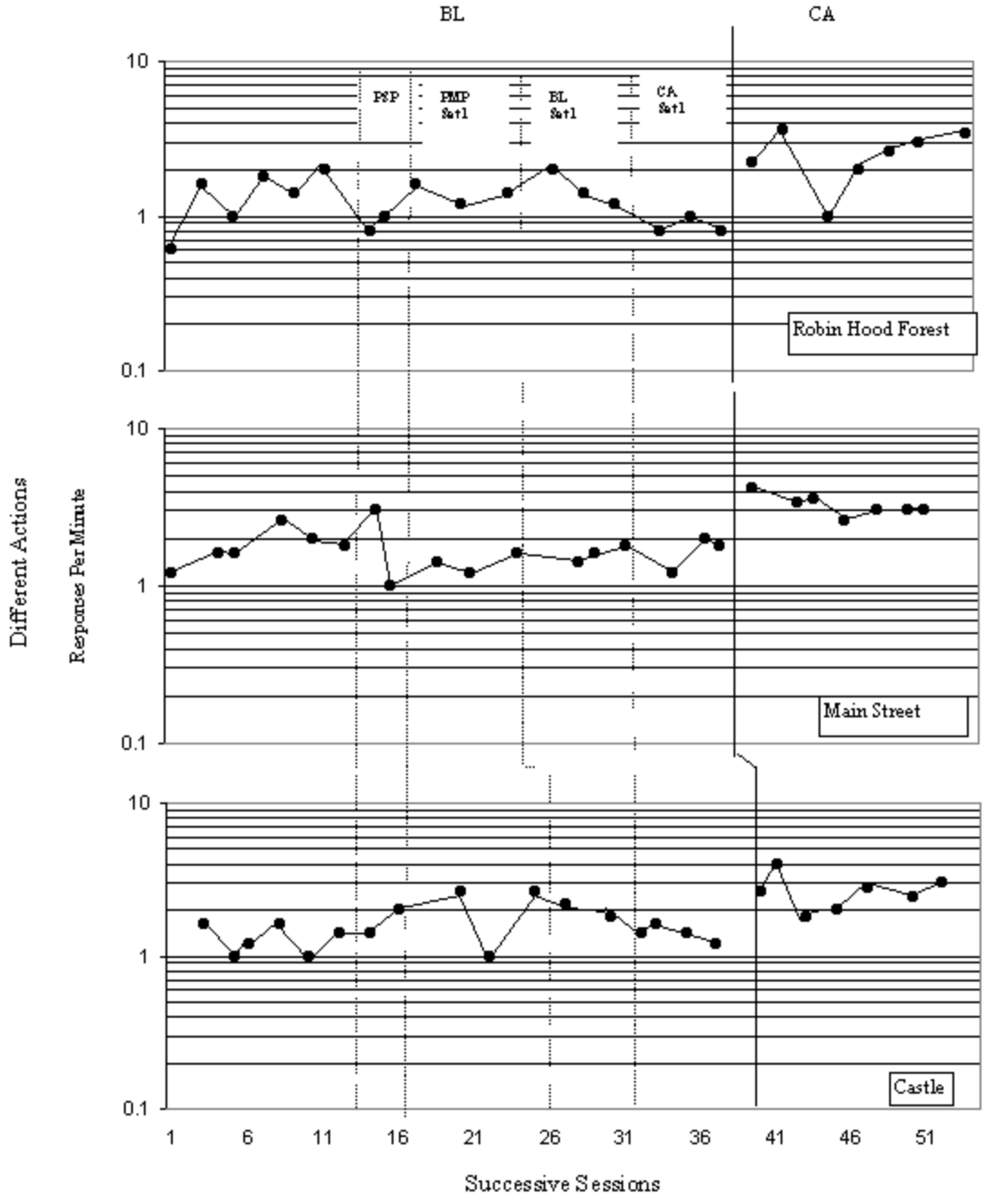


Figure 7. Rate of different actions per minute across baseline (BL) and contingent attention (CA) conditions for Set 2.

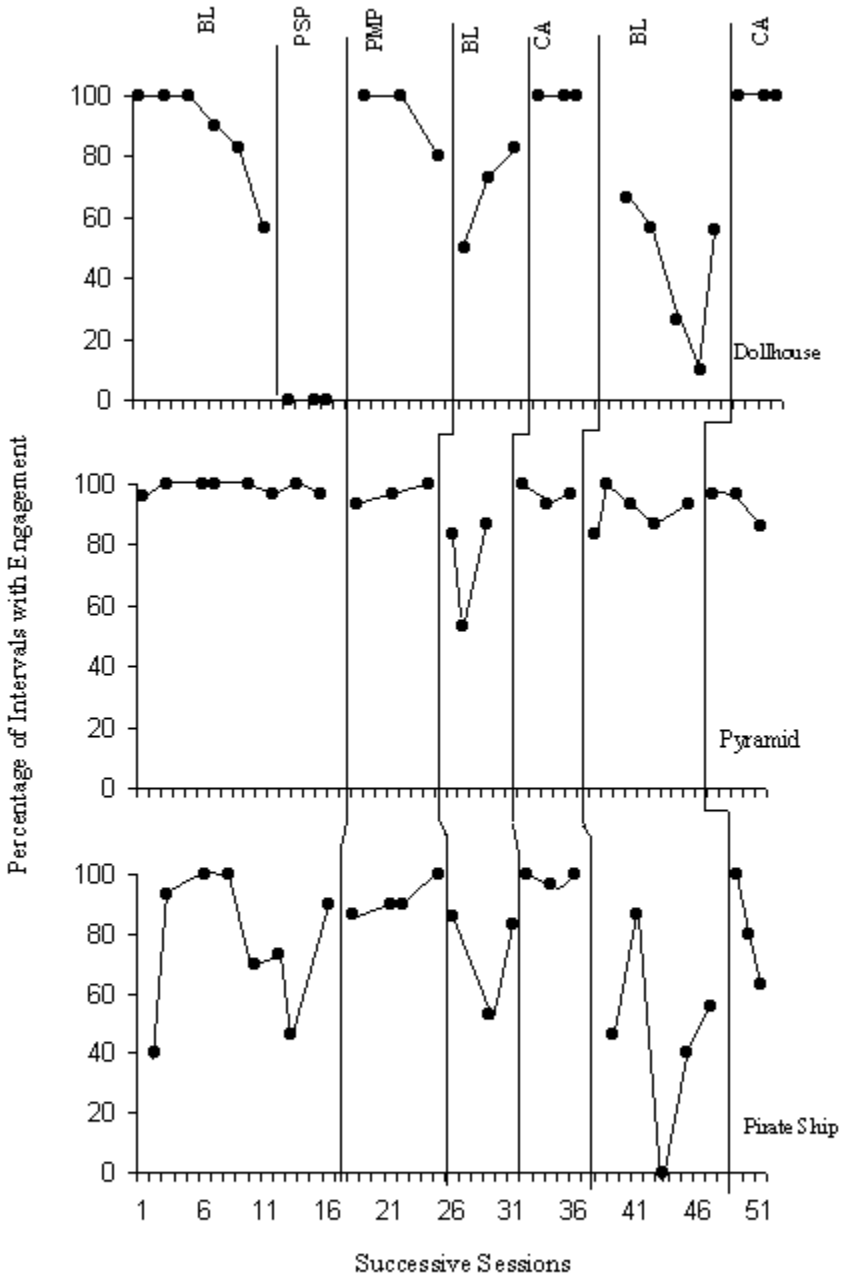


Figure 8. Percentage of interval with engagement across baseline (BL), Prime: Single probes (PSP), Prime: Multiple probes (PMP), and contingent attention (CA) conditions for Set 1.

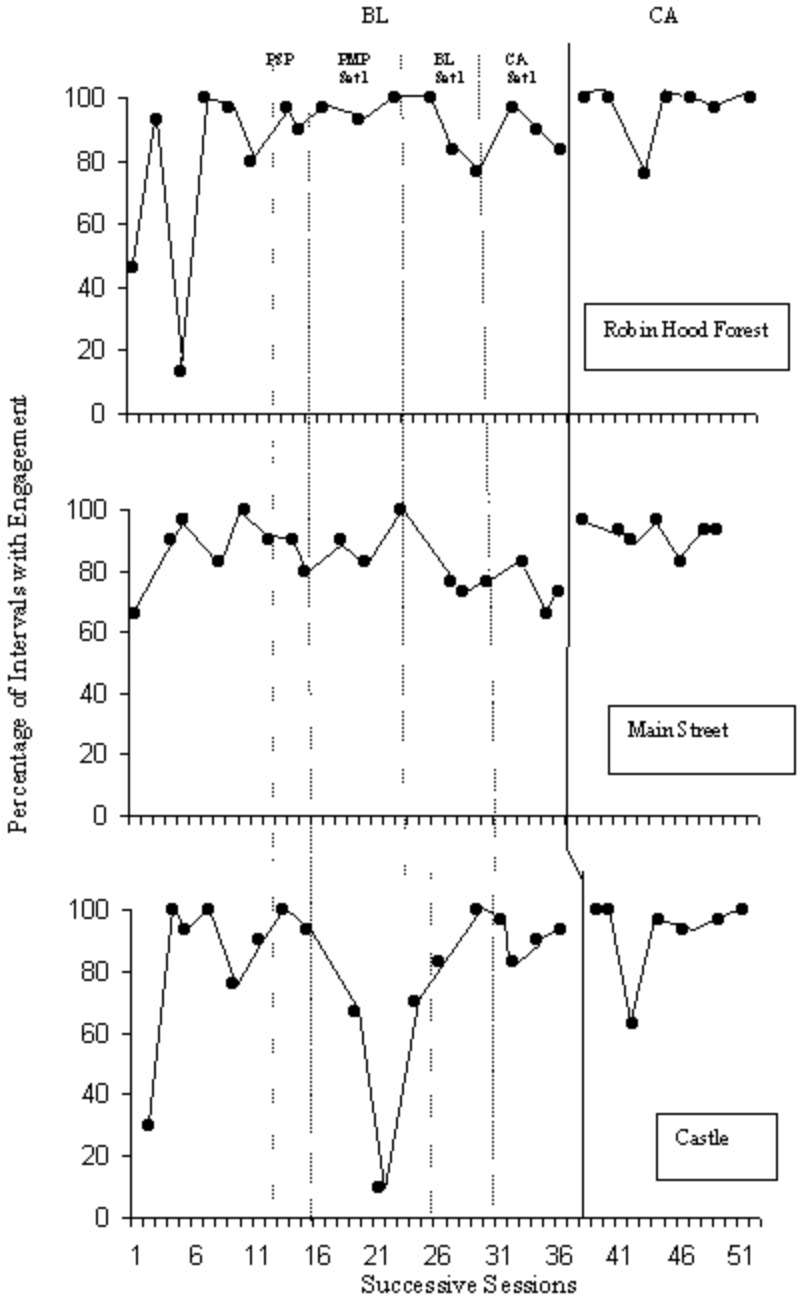


Figure 9. Percentage of engagement across baseline (BL) and contingent attention (CA) conditions for Set 2.

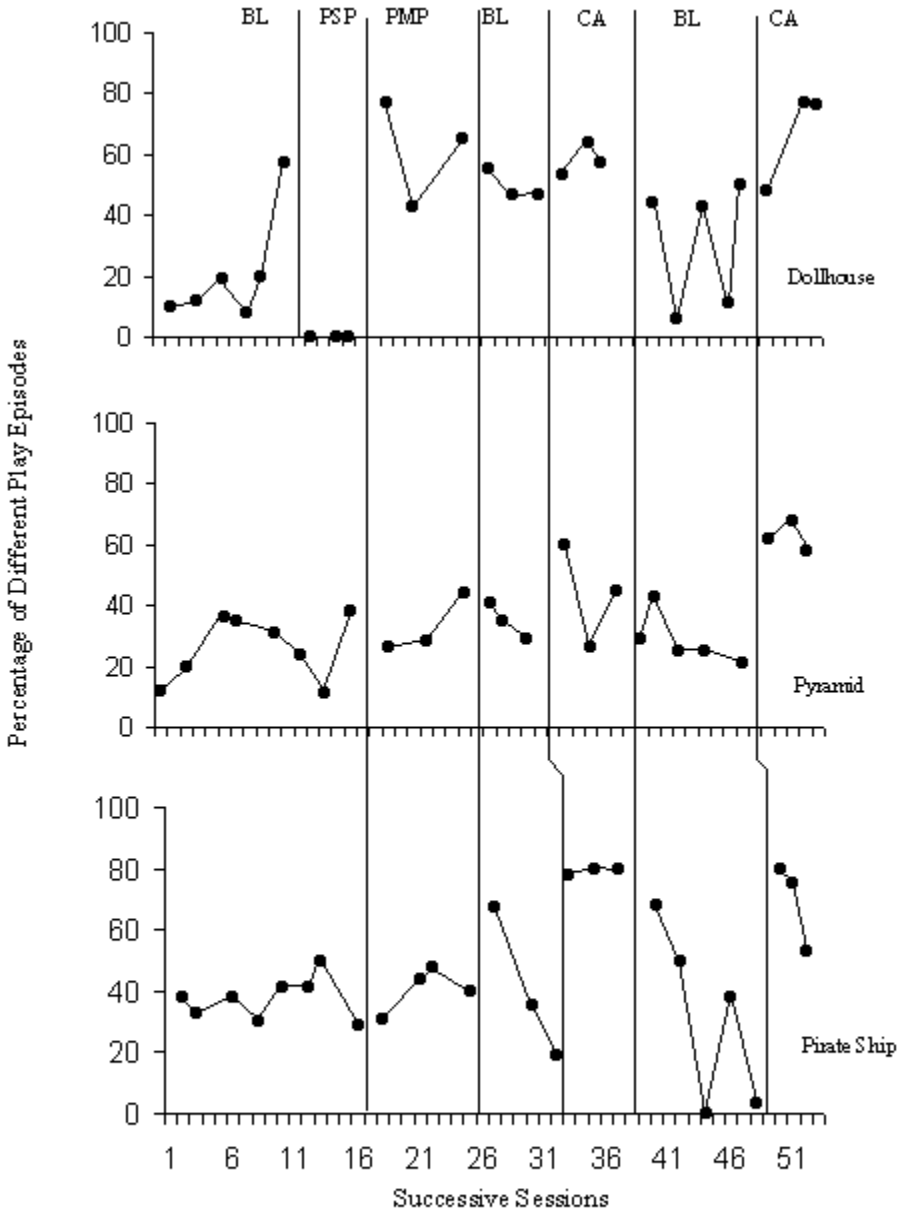


Figure 10. Percentage of different play episodes across Prime: Single probes (PSP), Prime: Multiple probes (PMP), and contingent attentions (CA) conditions materials for Set 1.

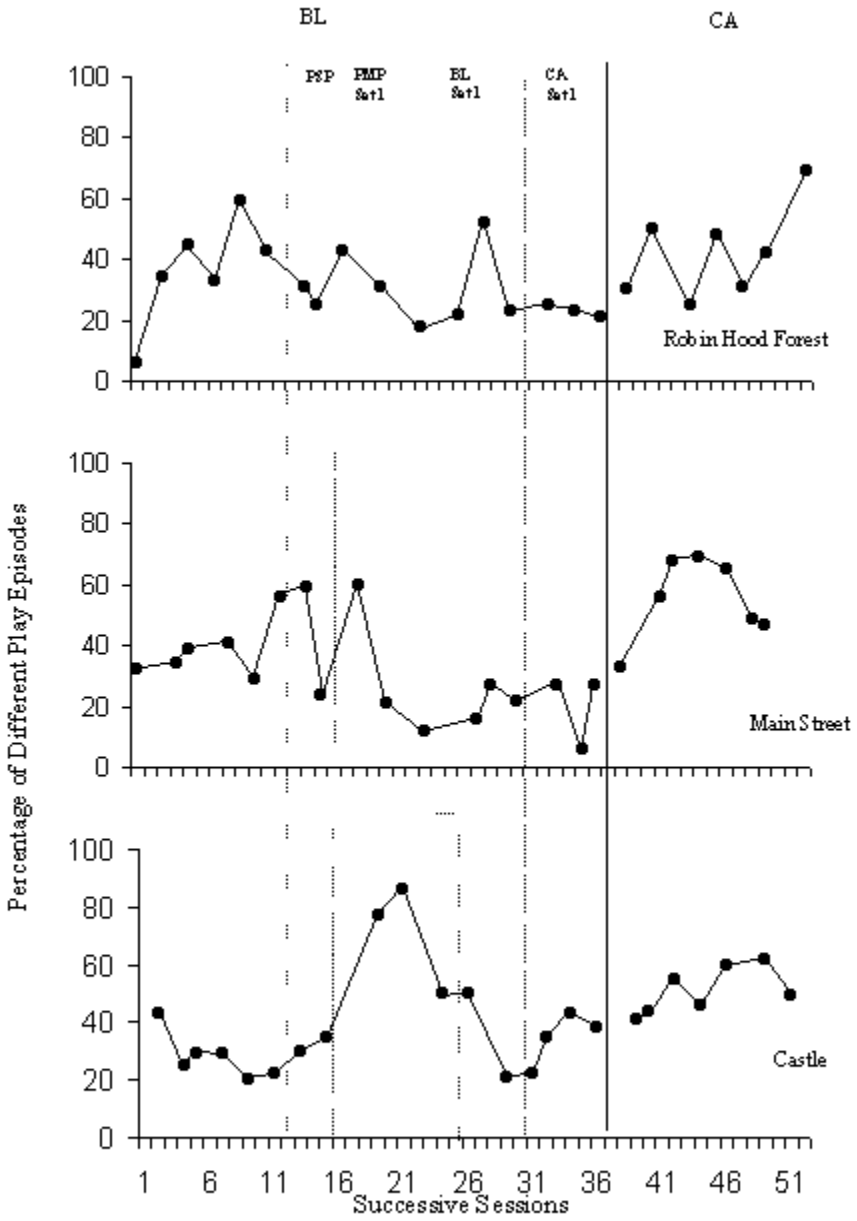


Figure 11. Percentage of different play episodes across baseline (BL) and contingent attention (CA) conditions for Set 2.

REFERENCES

American Psychiatric Association (1994). Diagnostic and Statistical Manual of Mental Disorders. Washington, DC: American Psychiatric Association.

Baker, M. J. Increasing the social behavior of young children with autism using their obsessive behaviors. Journal of the Association for Persons with Severe Handicaps, 23, 300-308.

Buell, J., Stoddard, P., Harris F. R., & Baer, D.M. (1968). Collateral social development accompanying reinforcement of outdoor play in a preschool child. Journal of Applied Behavior Analysis, 1, 167-173.

Denney, J., & Neuringer, A. (1998). Behavioral variability is controlled by discriminative stimuli. Animal Learning and Behavior, 26, 154-162.

Duker, P.C., & Van Lent, C. (1991). Inducing variability in communicative gestures used by severely retarded individuals. Journal of Applied Behavior Analysis, 24, 379-386.

Eckerman, D. A., & Lanson, R. N. (1969). Variability of response location for pigeons responding under continuous reinforcement, intermittent reinforcement, & extinction. Journal of the Experimental Analysis of Behavior, 12, 73-80.

Goetz, E. M., & Baer, D. M. (1973). Social control of form diversity and the emergence of new forms in children's blockbuilding. Journal of Applied Behavior Analysis, 6, 209-217.

Hardiman, S. A., Goetz, E. M., Reuter, K. E., & LeBlanc, J. M. (1975). Primes, contingent attention, and training: effects on a child's motor behavior. Journal of Applied Behavior Analysis, 8, 399-409.

Haring, T. (1985). Teaching between-class generalization of to play behavior to handicapped children. Journal of Applied Behavior Analysis, 18, 127-139.

Johnson, J., Chrisite, J., & Yawkey, T. (1999). Play and Early Childhood Development. New York, NY: Longman, Inc.

Joyce, J. H., & Chase, P. N. (1990). Effects of response variability on the sensitivity of rule-governed behavior. Journal of Applied Behavior Analysis, 54, 251-262.

Lalli, J. S., Zanolli, K., & Wohn, T. (1994). Using extinction to promote response variability in toy play. Journal of Applied Behavior Analysis, 27, 735-736.

Linder, T.W. (1990). Transdisclipinary Play-Based Assessment. Baltimore, MD: Paul H. Brookes Publishing Co.

Lifter, K. (1995). Strategies that make sense. Journal of Early Intervention, 19, 106-107.

Machado, A. (1989). Operant conditioning of behavioral variability using a percentile reinforcement schedule. Journal of the Experimental Analysis of Behavior, 52, 155-166.,

Machado, A. (1992) Behavioral variability and frequency-dependent selection. Journal of the Experimental Analysis of Behavior, 58, 241-563.

Macintyre, C. (2001). Enhancing Learning Through Play. London: David Fulton Publishers.

Morris, C. J. (1987). The operant conditioning of response variability: Free-operant versus discrete-response procedures. Journal of the Experimental Analysis of Behavior, 47, 273-277.

Musslewhite, C. (1986). Adaptive Play for Special Needs Children. San Diego, CA: College-Hill Press.

Murphy, G., Callias, M., & Carr, J. (1985). Increasing simple toy play in profoundly mentally handicapped children. I. Training to Play. Journal of Autism and Developmental Disorders, 15, 375-388.

Miller, N., & Neuringer, A. (2000). Reinforcing variability in adolescents with autism. Journal of Applied Behavior Analysis, 33, 151-165.

Neuringer, A., Deiss, C., & Olson, G. (2000). Reinforced variability and operant learning. Journal of Experimental Psychology: Animal Behavior Processes, 26, 98-111.

Potucek, J. A. (1989). Expanding the play repertoire of a child with autistic characteristics. Unpublished master's thesis. University of Kansas, Lawrence, Kansas.

Pryor, K., Haag, R., & O'Reilly, J. (1969). The creative porpoise: Training for novel behavior. Journal of the Experimental Analysis of Behavior, 12, 653-661.

Ross, C., & Neuringer, A. (2002). Reinforcement of variations and repetitions along three independent response dimensions. Behavioral Processes, 57, 199-209.

Sayeed, Z., & Guerin, E. (2000). Early Years Play: A Happy Medium for Assessment and Intervention. London: David Fulton Publishers.

Schwartz, B. (1980). Development of complex, stereotyped behavior in pigeons. Journal of the Experimental Analysis of Behavior, 33, 153-166.

Wolfberg, P. J. (1999) Play & Imagination in Children with Autism. New York, NY: Teachers College Press.